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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Acknowledgment.

The response of the numerous business acquaintances and friends of the undersigned, whose confidence was gained while we were in charge of the affairs of The Egyptian Lacquer Mfg. Co., shown by the hearty replies to the announcement of the formation of the

Zeller Lacquer Manufacturing Company,
Incorporated

is most gratifying. On account of the volume of such kind communications we have been unable to reply in each instance, but desire herewith to express our sincere thanks and appreciation.

HUGO ZELLER,
RICHARD ZELLER
GUSTAV O. ZELLER.

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Vol. 19 NEW YORK, APRIL, 1921 No. 4

Pouring Temperatures

How They Affect Casting Shrinkage and Solidity*

By R. R. CLARKE, Springfield, Ohio

This discussion concerns chiefly those castings in which bulk is heavy or variable, or the ratio of volume to surface high. Examples are a 6-inch cube, a 5-inch pin brass 12 inches long, a valve body, a flanged bushing, etc. In using the word shrinkage we observe the sense of drawing, sinking or receding of metal at its highest or heaviest casting vicinities or between the variables of bulk where the shrinkage is unusually strong and exceedingly local.

Briefly the propositions at hand are:

1. Shrinkage decreases as temperature rises.
2. Cleanliness and compactness advance with temperature.
3. A closely defined and dangerous limit intercepts a rising temperature, marking the activity of gases and oxides and making for a most distressing condition in the castings.
4. Hot pouring necessitates molding with that end in view.

FLUIDITY IS FACTOR IN SHRINKAGE

That shrinkage should decrease as temperature rises is an apparent contradiction, since expansion's law is to advance with temperature and measure a corresponding contraction in return to normal. No doubt the explanation rests in part at least on the greater fluidity enabling the metal to generate and transmit higher gate pressure, run the mold more searchingly and establish and maintain better communication between its parts.

The primary advantage of hot pouring is a clean, solid, unshrunken casting realized through a comparatively small gate easily removed. Instances could be cited where a change of gating practice and pouring temperature reduced the gate metal from 100 pounds to 20 pounds and cut down cleaning time and expense, melting loss, etc., correspondingly.

Additional advantages are the suppression of the hair line fracture, of gate pin holes, and the nullified effect of molding inconsistence to which cold metal is so peculiarly sensitive. Against a hard cope or damp core, cold metal immediately solidifies, preserving the effect. Hot metal contends against the condition and often prolongs fluidity beyond the activity of the cause.

The hair line fracture is a modified form of recession caused by unequal contraction and intensifying with erratic molding such as wet sand, hard ramming, sparse venting, etc. In my experience it seldom seriously attends hot pouring but to greater or less degree is always emphasized by cold pouring.

REQUIREMENTS OF HOT METAL MOLD

A hot metal mold requires sand rather dry, rammed hard, faced well, vented freely and clamped or weighted securely in pouring. Similar precautions should be taken against the burning in of cores.

The author's experience leads to the belief that within certain limitations there is a suggestion of identity between the running capacity of metal in light thin castings and its power to resist shrinkage in bulky castings or variables between volume; that the ability of metal at proper temperature to run a thin gate and light casting is at least an indication of its function at the same temperature to go through the same gate to a clean, solid, unshrunken bulky casting. Both experience and experiment contribute to this inference under certain limitations as previously stated.

Hot pouring and solid castings apply more directly to the more common copper-tin, copper-in-lead and copper-tin-lead-zinc alloys such as 90 copper 10 tin, 88 copper 10 tin 2 zinc, 80 copper 10 tin 10 lead, 85 copper 3 tin 5 lead 3 zinc, but weakens in those metals and combinations having an unusually high contractive tendency. Among the latter are pure copper, monel metal, yellow brass, manganese bronze, aluminum bronze, tobin bronze, muntz metal and other high zinc mixes. A further striking feature of shrinkage is that new metals or combinations on first melting usually advance shrinkage beyond that of a succeeding manipulation. Metal melted and pigged and then remelted and cast or that representing part new, part remelt will usually show less shrinkage than all new metal cast on first melting.

High pouring temperatures are difficult chiefly because of extreme oxidation and the occlusion and expulsion of gases resulting in porosity. They therefore call for extreme caution and judgment. Beyond the danger line metal has sometimes a curdled-milk appearance, sometimes a dull-colored surface crust and sometimes a wicked looking exhibition of the varying colors arising from the different constituents such as tin, lead, etc. Another phenomenon of transgression is a spattering or crackling sound as that of boiling slag. Metal at such temperature will often appear mushy and cold and consequently deceiving as to its temperature when judged solely on its appearance of fluidity. These are dangers we might state we have encountered mostly in air and oil melting. On the other hand, cold pouring because

*A paper read at the meeting of the American Foundrymen's Association in Columbus, O., October 4-8, 1920, with additional sketches and descriptions.

of low fluidity weakens cohesion, strengthens metals' power to hold and include its dirt and dross and denies that gate pressure deriving from the hydrostatic principles.

Many actual cases could be cited in proof of these arguments, among them the casting of heavy valve bodies, trolley wheels, heavy pin brasses, large bushings, heavy gear wheels, brazing flanges, pressure castings and many others.

Heavy shrinking and drawing occurred in valve discs (see Fig. 1) at A, B, C and D, resulting in leakage under test. Higher temperature in pouring overcame it. Alloy: Cu—87; Sn. — 8; Zn — 5.

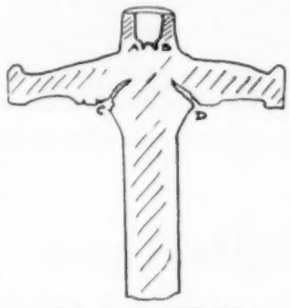


FIG. 1. VALVE DISC POURED COLD.

FLANGES.

The brazing flange castings, by cold pouring, come rough and with a wavy surface, besides showing a marked shrinkage on the cope side. They usually show gate pin holes and other internal shrinkage cavities. Poured at a higher temperature these effects disappear. Alloy: Cu. — 86; Zn. — 14.

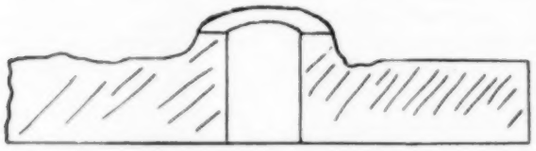
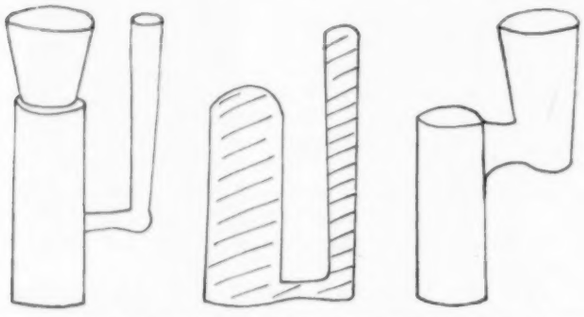


FIG. 2. BRAZING FLANGE.

PIN BRASS.

In Figs. 3, 5 and 6 the gates are very heavy and the metal is poured cold. In Fig. 4 the top of the mold is cut or scalloped out to compensate for shrinkage.



FIGS. 3, 4 AND 5, SHOWING DIFFERENT METHODS OF GATING HEAVY PIN BRASS.

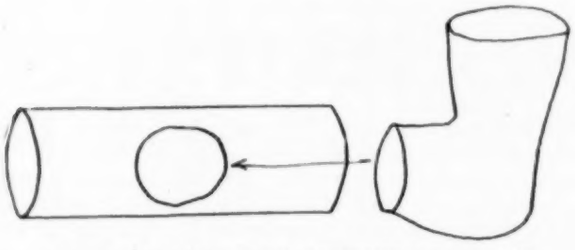


FIG. 6. PIN MOLDED IN HORIZONTAL POSITION.

In Fig. 7 the gates are light and the metal poured hot. Castings of highest quality have been and are being made by this method. In Fig. 6 the gate was practically as heavy as the casting.

Beveled gear blanks shown in Fig. 8 are another instance. When poured cold, 20% of the castings machined up are defective. Poured hot, 5 out of 300 failed in the machining. The alloy was made up of copper — 85; tin — 5; zinc — 5; lead — 5.

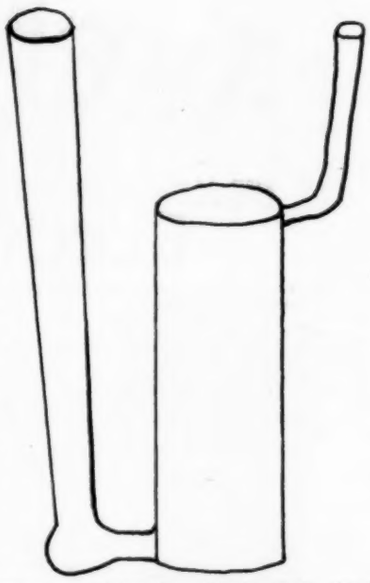


FIG. 7. CASTING GATED FOR HOT POURING

FIG. 8. CROSS SECTION OF BEVELED GEAR BLANK.

FIG. 9. CROSS SECTION OF TROLLEY WHEEL.

Trolley wheels (see Fig. 9) poured cold showed fractures at A and B. Poured hot, these cracks did not appear.

Large half-liners (see Fig. 10) weighing close to 900 lbs. showed heavy shrinkage at A and B, besides long longitudinal seams arising from imperfect unions of cold metal. Heavy risers at A and B failed to prevent this shrinkage. By pouring them hotter, these defects were corrected and very little additional difficulty was experienced.

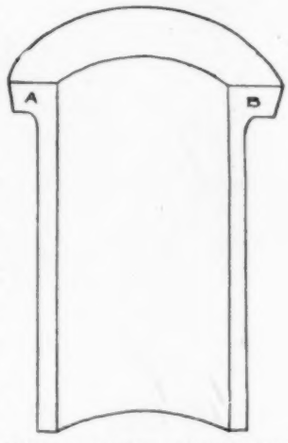


FIG. 10. LARGE HALF-LINERS.

BOILER CONNECTIONS.

Boiler connections, shown in Fig. 11, evidenced shrinkage and even rupture at D and E when poured cold. This disappeared when hotter metal was used. The alloy was made up of the same mixture as the casting shown in Fig. 7, namely, copper — 85; tin — 5; zinc — 5; lead — 5.

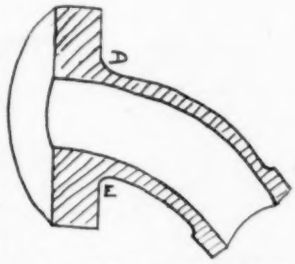


FIG. 11. BOILER CONNECTION.

New Types of Electric Furnaces

A Description of the Latest Development in Muffled Arc Furnaces

Tests on two new types of electric furnaces developed by the General Electric Company for melting non-ferrous metal, show, it is stated, a percentage of metal loss for yellow brass of less than 1.5% and less than .75% for red brass. The thermal efficiency is said to be high, and the expense for refractories and electrodes low.

These furnaces have been designed in two sizes, a 1,500 lb. unit and a 50 lb. unit. Either will melt practically any metal requiring a pouring temperature not exceeding 1,500° C. (2,372° F.). The 1,500 lb. unit is particularly adapted for use in the larger metal melting foundries, whereas the smaller unit will find a large field in small jobbing foundries, manufacturing plants, laboratories and in similar classes of work. Fig. 1 shows an experimental furnace. In the final design many mechanical improvements have been made.

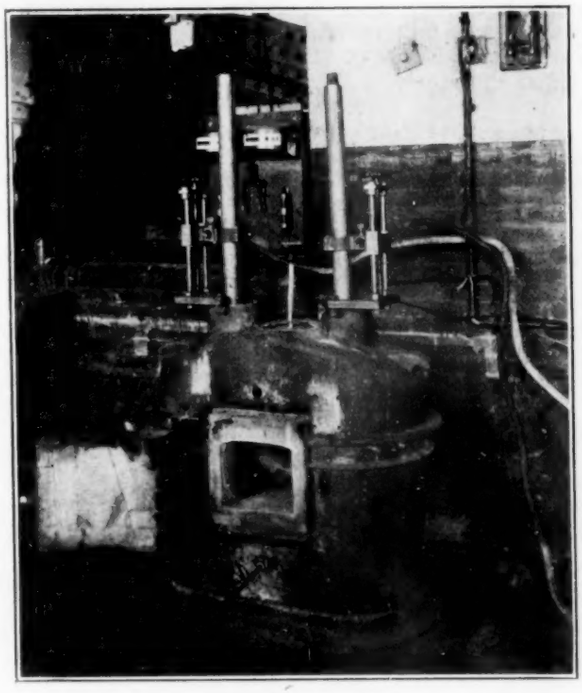


FIG. 1. EXPERIMENTAL FURNACE.

Both furnaces work on the muffled arc principle, the main difference in construction and design being due to the variation in size, and the fact that the 1,500 lb. type is 3 phase and the 50 lb. is single phase. The power factor for both is .95 or better.

The 1,500 lb. furnace melts yellow brass, pouring at 1,100° C., at 270 K. W. H. per ton, operating 24 hours a day, with one heat every hour.

The 1,500 lb. furnace it is claimed forms a balanced and very steady load on a poly-phase circuit, and is equipped with electrode regulators which automatically maintain the desired power input. It has a shell built of steel plate, lined with standard fire clay shapes, and having a bulged boiler head bottom. The roof frame is hinged to a bar in the shell at the front of the furnace, the same bar carrying a three-legged cast iron spider which mounts the electrode supporting mechanism. This permits the whole top of the furnace to be lifted, for repair of the lining, without disturbing the electrodes.

Fig. 2 shows the interior arrangement of the three D shaped muffles, wearing blocks, cross electrodes, and vertical electrodes which comprise the heating elements. As

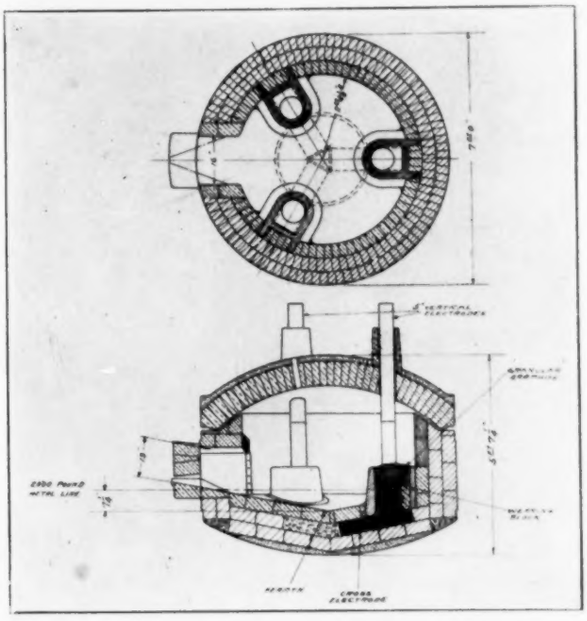


FIG. 2. CROSS SECTIONS SHOWING INTERIOR ARRANGEMENTS.

shown, the space in the muffle between the electrode and wearing block, and the side of the muffle, is filled with

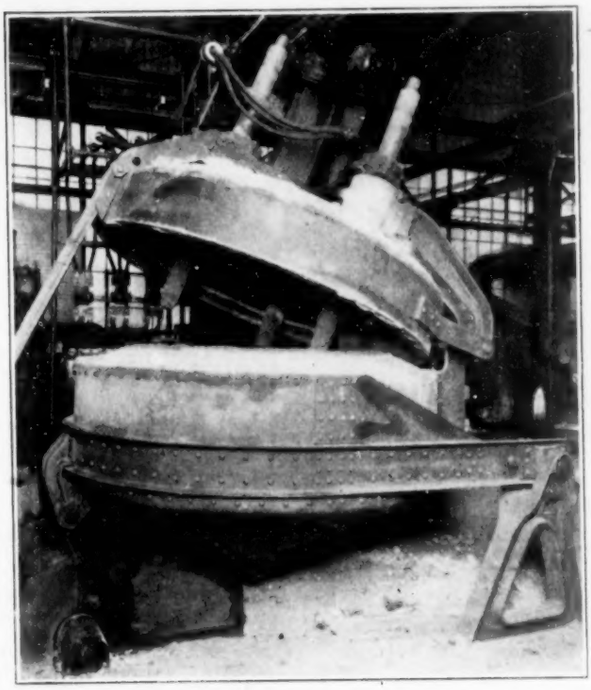


FIG. 3. 1,500 LB. FURNACE WITH TOP UP.

crushed graphite to muffle the arc. The triangular space where the cross electrodes meet in the middle is filled with

graphite and tar to insure a good electrical connection.

The 50 lb. furnace is constructed on much the same principle except that in this case the hearth is flat, designed to receive standard graphite crucibles. There is also some difference in the electrode and block arrangement, since the furnace is for single phase operation. A horizontal carbon block, imbedded in crushed graphite, extends across the bottom, carrying a wearing block on each end. Between these wearing blocks are four carborundum bricks which form the hearth. Two graphite electrodes extend through the roof to the wearing blocks, the arcs being smothered in the graphite surrounding the blocks. The electrode regulation is entirely manual, and is accomplished by adjusting the wheels on the electrode holders. In operation the crucible containing the metal to be melted is set on the carborundum brick hearth.

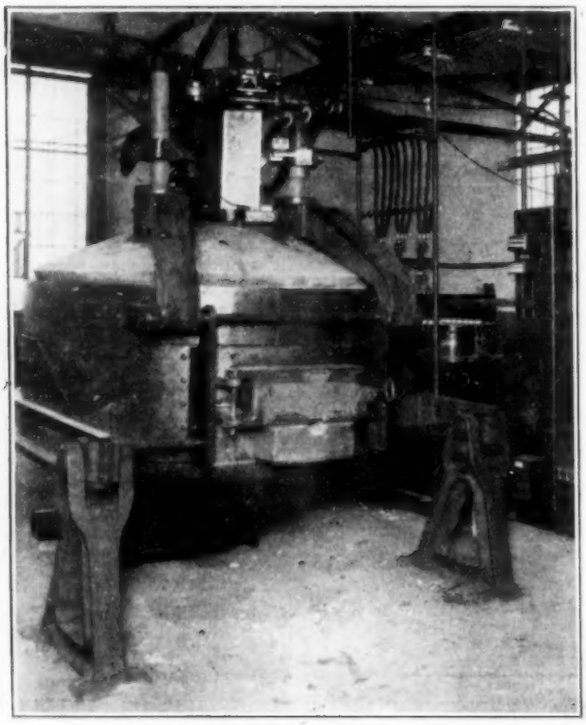


FIG. 4. FRONT VIEW OF 1,500 LB. FURNACE.

The metal is heated by the same action in both furnaces. The current flows from the vertical electrodes through arcs to the crushed graphite and the wearing blocks. These arcs are smothered by the graphite in the muffles, the whole mass becomes heated, forming a heat source of large area and uniform temperature. The heat is radiated to the metal from all directions as well as being absorbed from the muffles and the hearth. The result is a highly uniform temperature distribution, free from hot spots.

Two principal disadvantages of the fuel fired furnace, which are eliminated in the electric furnace, are high metal losses and low thermal efficiency. There are also other points but they are more or less contributary to the two mentioned. Nearly all these troubles, including the high metal loss, are due to the gases and combustion and difficulty of temperature control. In brass melting for instance, it is very difficult to obtain the proper atmosphere and temperature inside the fuel furnace, with the result that the zinc is either oxidized by the gas, or volatized by too great heat. The same is true of other metals used as alloys, such as tin, or lead, all of them being readily oxidizable at the temperature necessary for melting and pouring. In fact the metal loss of the fuel fired furnace is in the neighborhood of from 2.5% to 8%, as against 1.5% or .75% for the electric, depending on the metal.

The reason for this is that in the electric furnace of the muffled arc type, the metal is not subjected to excessively high temperatures, nor to an oxidizing atmosphere. There are no gases of combustion, and the metal never comes in contact with the arcs. Also the flexible and accurate temperature control makes it possible to obtain exactly the right temperature without danger of volatilization. The expense for recovery of metal from ashes and slag is greatly reduced by an electric furnace.

As to the comparative thermal efficiency, that of the electric furnace ordinarily ranges from 30 to 80% depending on operating conditions. Under the same conditions the efficiency of the fuel fired furnace ranges from 1.5% to 16%, the average being 7%.

The Aluminum Industry in Norway

By HALLVARD B. SAETER

Norway has about 15 million horsepower in waterfalls. Of this power about 12 millions are undeveloped. Many of these waterfalls are close to the sea with excellent harbors. The electric water powers in the other European countries with their dense populations will be utilized gradually for public service and there is no doubt that Norway is destined in the future to be the site for many electrochemical industries where cheap power and shipping facilities are large items in the production cost.

One of these industries is the aluminum industry. From one factory with 1,800 Kw. and a production of 400 tons per year in 1907 the industry has increased to five factories, a total power installation of about 60,000 Kw. and a capacity of about 16,000 tons per year.

The first aluminum factory in Norway was erected at Stangfjorden on the west coast. This factory is owned by the British Aluminium Company and the production is about 400 tons annually. Later the British Aluminium Company built a factory at Vigeland in Southern Norway and installed about 11,000 Kw. producing 2,400 tons per year.

During the war several factories were built and are now producing aluminum. Det Norske Nitridaktieselskap has one factory at Eydehavn with 18,000 Kw. installed and a capacity of about 5,000 tons per year. Besides this the same company has a factory at Tyssedal using about 10,000 Kw. A. S. Hoyangfaldene Norsk Aluminium Company has installed 23,000 Kw. for a production of 6,000 tons aluminum per year. All these companies have besides, the aluminum factories, also their own electrode factories.

As stated above the producing capacity of these works is about 16,000 tons per year. The actual production is at present considerably below this figure. The production has up to the present time been aluminum in bars which have been exported. Aluminum has to a small extent been rolled in brass rolling mills, and there have been established some small utensil factories and a foil factory. One of the aluminum factories has now formed a subsidiary company Nordisk Aluminium Industri and this company has built a utensil factory in connection with a rolling mill and a die casting foundry and it is expected that Norway soon will supply its own needs of aluminum goods and will also export sheets, foil, wires and utensils.

Casting Problems

Some Difficulties and Their Solutions

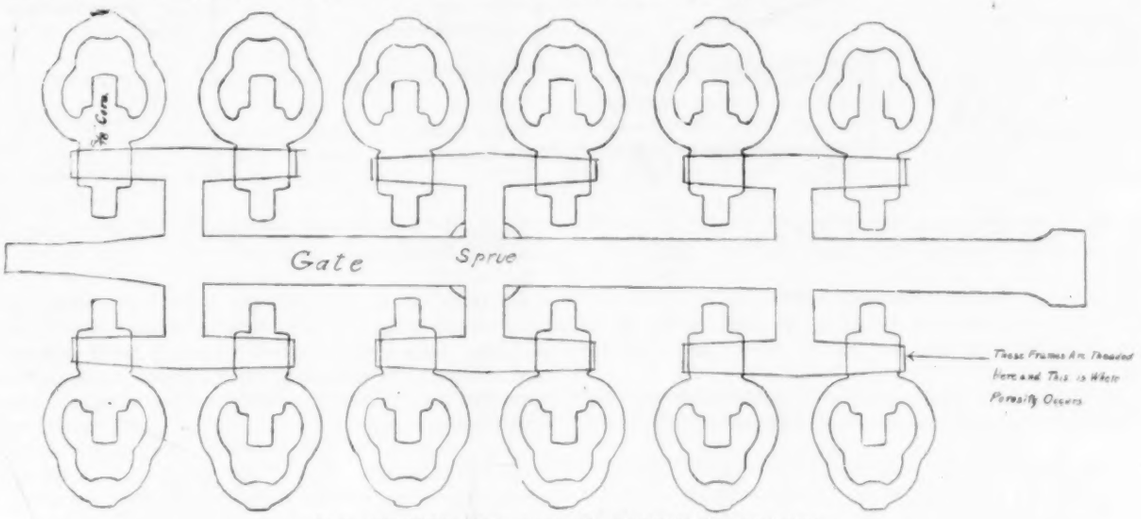
Written for The Metal Industry by WILLIAM J. REARDON, Foundry Editor

Casting Sprinkler Frames

Q.—We write to inquire if you can give us a helpful suggestion regarding a difficulty which we have recently encountered.

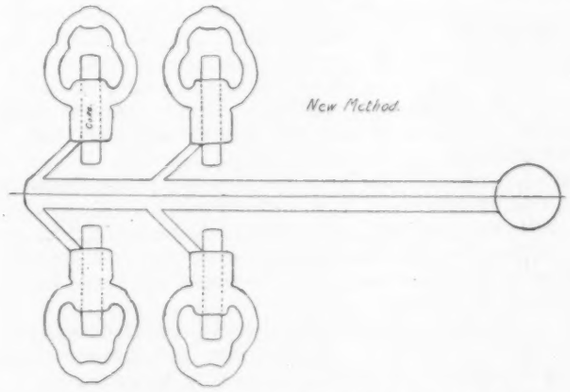
Enclosed you will find a tracing which illustrates the manner of our gating sprinkler frames which we are now casting in green sand. We use a snap flask, gated from the center, on a vibrator frame. The mold is flat when poured. The formula of metal used is copper 89, tin 6, zinc 3, lead 2, phosphor copper 4 ounces. We exercise every care which we know of in regard to getting the proper pouring temperature, and yet we receive complaints of porosity in the stem of the head. This porosity is practically invisible to the eye, but when the heads are put under a high water pressure they leak very slightly and are consequently rejected.

We will appreciate any suggestion which you can offer us. If further information will aid you, we will be glad to forward it.



OLD METHOD OF GATING SPRINKLER FRAMES.

A.—The mixture of metal you are using, 89 copper, 6 tin, 3 zinc, 2 lead, phosphor copper 4 ounces, is exceptionally good, and we believe the trouble is in the gating of the casting, as the way in which the gates run into the casting, causes the casting to feed the gate instead of the gate feeding the casting, thereby causing shrinkage which causes the castings to leak under pressure. We would suggest that you change your gate as per sketch and pour from the end with the mold slightly inclined. In gating brass, the rule to follow is that the casting should set before the runner or gate. If you gate as suggested, very little trouble will be had on this style of casting.



NEW METHOD OF GATING SPRINKLER FRAMES.

Casting Brass Handles

Q.—We are making some brass handles, weighing between 8 ounces and 1 lb. each, which have to be finished up and nickel plated and are having difficulty on account of porus castings.

Would you advise us a mixture which would be suitable and also what precautions in melting would help prevent this trouble? Can we use scrap for this work and if so what proportion to other metal?

A.—This class of castings is generally made in as cheap a mixture as possible, and yellow brass is suitable for this purpose. One mixture that gives very good results is composed of 58½ copper, 41 zinc, ½ aluminum. Care must be taken that no lead gets into this mixture or it will run dirty, brittle and porous. Wherever aluminum is used in brass, lead must be eliminated entirely or castings will be porous.

METHOD OF GATING BRASS HANDLES.

Sheet yellow brass can be used, and the aluminum is added to this without any other new metal being added. However, in using this class of metal care must be taken in gating. The best plan is to give the metal a long run and to gate as shown in the sketch.

Another mixture that gives good results and is easy to handle, but costs a little more, is composed of 73 copper, 23 zinc, 2 lead, 2 tin. A good scrap mixture to use, which approaches this mixture, is 60 sheet yellow brass, 36 copper, 2 lead, 2 tin. It is also essential that careful attention is paid to details in melting the metals, and that the brass is protected from the atmosphere, while it is being melted. Charcoal should be used to cover the metal. A little salt is an excellent flux to use while melting. Do not allow the brass to stay in the furnace after it is melted. If this can not be avoided push the furnace cover aside so that the fire will not burn so strong, but pour as soon as possible. Stir and skim off before the brass is poured.

FIG. 1.

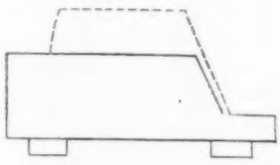


FIG. 2.

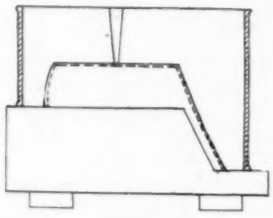


FIG. 3.

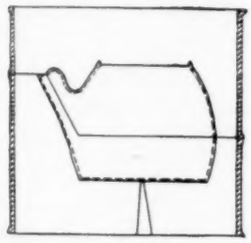


FIG. 4.

Fig. 1. The Brass Shell Pattern split as shown.
Fig. 2. The Follow Board or Parting Board for cope half of pattern.
Fig. 3. Place flask and ram up cope on follow board or parting plate.

Fig. 4. Roll over the flask, place drag half of pattern, ram the inside core, make parting at line indicated, place drag half of flask, ram, lift off, draw drag of pattern, close mold and roll over.

Casting Aluminum Kettles

Q.—We will be pleased to have you advise us as to the proper mixture to use for casting aluminum cooking utensils.

We are having a great deal of trouble with the tea kettle as they continue to crack on the sides. This job is made with a dry sand core, and while we have tried several mixtures of hard and soft cores, also alloyed our metal in various ways, they continue to come with one or more fractures.

Kindly advise us as to the composition for metal and cores for this work.

A.—If it is your intention to produce cooking utensils regardless of cost, the purer the aluminum the better, and I would suggest a mixture of 96 aluminum, 2 copper, 2 magnesium. No. 12 alloy can also be used. This is composed of 92 aluminum, 8 copper.

It is necessary for the success of this method casting tea-kettles, that good equipment be obtained which should include a brass pattern and an aluminum flask.

In pouring it is necessary to fill the gate with one turn of the ladle. If you stop or move so that the metal will not keep the gate full you will have a scrap casting. If you handle this arrangement as it is intended your production will be 100%. One should make 60 to 75 molds per day.

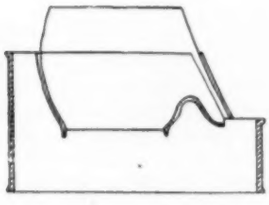


FIG. 5. LIFT OFF COPE AND DRAW COPE HALF OF PATTERN.

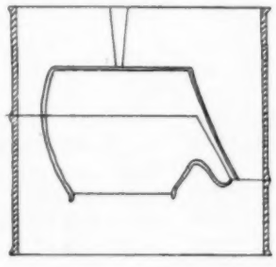


FIG. 6. CLOSE MOLD READY FOR POURING.

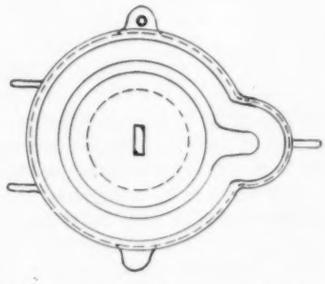


FIG. 7. TOP VIEW OF ALUMINUM FLASK.

COPPER NICKEL ALLOYS

By ROLLER

Alloys of copper and nickel are difficult to cast and obtain uniform results. Care must be taken to select metals as free from impurities as possible and particular pains should be taken to see that the nickel is practically free from carbon.

If graphite crucibles are used it is well to give the inside of them a coating of fire clay. Borax makes a good flux and should be put in with the metal at the time it is charged. If too much borax is used it will cut the walls of the crucible. Practice will determine the right amount; two or three lumps about the size of a walnut generally suffice.

The metal should be brought to nearly a white heat in the furnace and when pouring it must run into the mold smoothly. If the metal spits or boils while being poured the castings will be defective. A very small amount of magnesium (about 1/10 of one per cent) added in the form of a copper-magnesium alloy will be found helpful.

After the metal has been cast a small piece should be dissolved in nitric acid; if small black flakes appear it indicates the presence of carbon and the metal will not be satisfactory. If the metal pours freely and does not show any indications of carbon no trouble should be experienced in rolling.

The annealing is preferably done in closed drums provided with a vent hole. Small pieces are sometimes annealed in closed retorts and packed in charcoal.

The pickling may be performed by using the regular dilute sulphuric acid solution with the addition of a small quantity of bichromate of potassium or bicromate of soda. This solution is generally used warm.

Riddling Molding Sand

Efficient and Inefficient Methods

Written for The Metal Industry by WILLIAM H. PARRY

It was not an uncommon sight forty years ago or so to see foundry helpers riddling sand on an inclined screen such as builders use even to this day in making mortar. The mesh of the screen did not seem to enter into the calculations those days so much as the muscle of the operators, and it wasn't much of a stunt to throw three or four cubic yards of sand at and through one of these riddles just to settle one's breakfast.

The advent of the hand-operated round riddle was hailed with delight by some foundry helpers, while others looked upon it as an infringement on a long cherished custom, but, when they realized that it was a two-man affair, one to shovel in and one to shake out, with the ever present opportunity of a little conversation on the side, they gave up all opposition to the so-called innovation. As a matter of fact, the adoption of the round hand riddle was a step backwards insofar as being a labor saver was concerned, as two men, with its help, could produce but little more, if any, riddled sand than one man would with a mortar screen.

It was many years later when the power operated riddle made its appearance, being a clumsy and heavy machine with a frame work of wood, and as hard wood was cheap those days they used plenty of it, with the result that it was not absolutely necessary to fasten the machine to the floor, a chock being sufficient to prevent its rambling proclivities. These machines were belt-driven with reciprocating action on the riddle and, as they were supposed to be stationary, the sand had to be brought to and taken away from them. This very often used up the energy of two men, and, as the machine did not stop to converse with either, both were pretty much on the jump, though I doubt that this machine plus two men produced twice as much riddled sand as the old-fashioned inclined screen did with one.

The next step in the evolution of sand riddling made its appearance in the shape of the rotating type. At last, said the experts, we can see our way out of the woods, and it must be said that as a sifter it had its good points. Some were square or hexagonal in shape, while others were cylindrical. Some were so designed that a 'tomtom" beater beat a tune on the outside of the riddle, the object being to prevent clogging the mesh. It did more than that, however, by punching holes in the screening, which, as I have mentioned, certainly did prevent clogging in the immediate vicinity of the holes. The weak spot in the armor of this machine's design was that it was not portable, or at least it was not so designed at first, hence the necessity of carting the sand to and from it.

Before leaving the sifters of the stationary type, mention must be made of the centrifugal machines, which, although it was not claimed that they were riddlers pure and simple, did that little thing, and thoroughly mixed the sand at the same time. In fact, there are many in use today and doing splendid work.

Then there is the brush type of mixer and sifter, which, as a type, is a radical departure from all accepted riddling rules, in that the sand is fed to a hopper located just over a rapidly revolving brush, the sand being ejected in as fluffy a condition as a toe-dancer's skirts, and put to much better use, I am sure. As both the centrifugal and the brush machines are of the stationary type, they are objected to by the up-to-date foundry men for use in the foundry proper, but many are in use in the core rooms of modern foundries.

The first portable sand riddler was put on the market some twenty-five years ago, and was at first rather clumsy to handle, but it did not take long for the makers to realize that all men are not Samsons and many pounds were cut off its weight. It is a very simple device, being operated by compressed air, or steam, in a cylinder, in all respects similar to that of an ordinary reciprocating steam engine, the piston rod outboard end being attached to the riddle frame, while the housing rests on a tripod shod with cast iron globular feet. This sifter can be operated in any part of the foundry within "bunting" distance of the air or steam line.

Compressed air is the ideal medium for the operation of this type, as, when the machines get old and leaky, it is not hard to locate them in a foundry using steam alone. Although wasteful of compressed air, these machines are money savers, and one man can turn out a glorious amount of work, particularly in supplying bench or machine molders in their stalls, with a constant pile of riddled sand.

The machines that have the vogue at present are of the gyratory or sand hog type, electrically driven, portable, light in weight; in fact, so light at first that they shook themselves apart before shaking enough molding sand to pay for their keep. However, they are built better now, and, while the gyrations of the one, and hoggishness of the other may not appeal to gentle natures, the average foundryman seems satisfied with their peculiar twists and twirls, shimmies and whatnots, as the riddled sand pours from their midst.

Both are so designed that they can be suspended from overhead rails at points nearest to where the sand is wanted, and of course close to the electrical sockets such as are ordinarily used for lighting. The power used by them is ridiculously low, as compared with the belt-driven types, and the saving in power alone will pay for them in a short space of time.

One of the best sand riddling stories now in circulation can be traced to the recent shortage of labor, due to war conditions.

As an incentive to a crew of foundry laborers, recently acquired through an employment agency that specialized in foreign help of the brawny kind, the foreman offered to pay them on the basis of full barrow loads, after trying by every means in his power to supply enough riddled sand to the molders and failing to get results thereby. The increase in output was most astonishing, and the foreman was congratulating himself on putting one over on the "Hunkies," when the molders put up an awful roar at the sand delivered to them. Same was filled with nails, lumps of core sand, bits of wood and metal and not a few gaggers.

Investigation proved that some profiteering genius had substituted peek-a-boo or open-work scrap metal riddles, with a 1¼ inch mesh, having an eye to quantity and profit, but not quality as produced by closer meshed riddles.

Foundry Mixtures

Baltimore Tablets

Copper	1 lb.
Tin	1 oz.
Lead	½ "
Zinc	½ "

Bell Metal

Copper	1 lb.
Tin	5 oz.

Bells

Copper	4 lbs.
Tin	1 "
Zinc	½ oz.
Lead	½ "

Casting Phosphor Bronze

A Question on Phosphor Bronze Testing and Its Answer

Written for The Metal Industry by R. E. SEARCH, Exchange Editor

Q.—We have some phosphor bronze castings to make, which must conform to composition given below:

Copper 85-90, tin 6-11, zinc not over 4%, iron max. 0.06, lead max. 0.2, phosphorus max. 0.5. With a minimum tensile strength of 45,000, minimum elongation of 20%.

Please advise how tests should be made.

It is also understood that scrap must not be used. We have tried everything we know of. We made tests on ⅞ in., round on end, and ⅞ in. square cast under 2-in. square block, also cast some the shape of the finished test in cores, so as to have very little to machine off. A tensile strength of 40,000 and elongation of 17% was the best we could get.

A.—This composition is almost the same as the Aeronautic Specification No. 56.—A metal which calls for copper 87-89; tin, 9-11; zinc, 1-3; iron, maximum, 0.06, and lead, 0.2, and requires a minimum tensile strength of 30,000 lbs. per sq. in., a minimum yield point of 15,000 lbs. per sq. in., and a minimum elongation of 15% in 2 in. Another alloy of a similar type consisting of 90-92% copper; 7.4-9.7% tin, and P, 0.3-0.6% has given the following results: Out of 16 tests only one failed to run over 39,000 lbs. per sq. in. tensile strength, and with an elongation in 2 in. of 20%. One of this group of alloys with 89% copper, 10% tin, no lead and 0.58% P. had a tensile strength of 59,136 lbs. per sq. in., and an elongation of 27% in 2 inches. It is believed, however, that this high result is exceptional and could not be duplicated often, nor be the average of 20 tests. These figures are given to show what has been done and possibly is why such a demand has been made upon you in the above specifications.

It is believed, however, that with proper attention being paid to the materials used, to the melting practice and correct pouring temperature, and correct gating and molding, a tensile strength of 39,000 lbs. per sq. in. and an elongation of 20% in 2 inches could be secured. The copper should be Lake Superior or the best electrolytic, the zinc should be the Horsehead brand or its equal, and the tin should be Banca, or the electrolytically refined tin now obtained in the American market.

Your difficulty in satisfying the specifications may be due to several causes which I shall try to point out to you. First, your method of making your mixture may be faulty. The proper way to do it is first to melt your copper under a heavy cover of lump charcoal (not fine stuff which always contains dirt). Also add nearly a tablespoonful of rock salt, not powdered common salt. When the copper is completely melted, not overheated, add the tin, then the iron in the shape of zinc-iron dross, run down in pig form from the settlings of the galvanizing tank. Then add your zinc, stir the whole charge with Acheson graphite rod (not with an iron poker); then before taking the pot from the fire add 1/10 of 1% of 15% phosphor copper and stir well.

Second, you may have poured the metal at too high a temperature. Most foundrymen do pour a phosphor bronze at too high a temperature when they first begin to use it. The difficulty of knowing when to pour a phosphor bronze if you judge by the naked eye is this. When such an alloy is apparently ready to pour it is as fluid as water, but it is next to impossible to tell by the eye its comparative degree of fluidity. A phosphor bronze alloy does not become gradually viscous in solidifying like an ordinary bronze, it remains very fluid until it is ready to freeze which it does suddenly. This fact makes it difficult to judge by the eye alone when it is ready to pour. Watch an old molder pour a heat of phosphor bronze. He will keep his eyes warily upon the pot of metal, but his fingers twitch at his skimmer, and the moment that the limpid surface gets the least bit dim, or the least particle of the metal sticks to the skimmer, then he pours at once. A better way than this is to plunge a quartz tube protected thermo-couple into the pot as soon as it is taken from the fire. The initial temperature may go as high as 1250 deg. C., but depends on the size of the castings. When the temperature falls to 1075 or 1100 deg. C., the metal should be poured.

The sand molds should be rammed so lightly as to be as open as possible. The pouring gates and runners should be sprayed with molasses and skin dried with a torch, and the runners should be previously coated with plumbago and smoothed down by thumb pressure or in some difficult cases a facing sand should be mixed up with the proper amount of linseed oil and the face of the mold baked hard.

Third. The shape of your test bar may have been incorrectly chosen. You should use the type, form, and dimensions with the longitudinal feed and wedge-shaped pouring gate recommended by A. S. T. M. specifications for 88-10-2 alloy. This shape of test bar will provide a uniform feed for the metal, also a uniform solidification of the metal and avoid any tendency to segregation and secure uniform results in the determination of the physical properties. Unless this precaution is taken contradictory results will ensue.

If you have taken every precaution I have mentioned in making your mixture, and use the A. S. T. M. test bar form for your test bars, and have failed in fulfilling the specifications, then you may rest assured that you have poured your metal at too high a temperature.

It has been my experience in foundry practice that very few men have the natural knack of knowing just how to melt a charge containing a high percentage of copper. The main thing is to have an exceedingly hot fire, run the copper down as rapidly as possible under a suitable charcoal covering, and stand right by the furnace and watch the copper go down, until the copper is as fluid as water, and shining back at you as a mirror, when you skim the charcoal on one side to look into its limpid face. When that stage is reached add the rest of the charge and do not wait a minute longer. Then, if you reach the right pouring temperature you will get the utmost that any melter can get out of such an alloy.

Foundry Mixtures

Silicon Bronze

Copper	3½ lbs.
Silicon	1½-2½ oz.

Manganese Bronze

Copper	56 lbs.
Zinc	42½ "
Tin	¾ "
Aluminum	½ "
Iron	1¼ "
Manganese	¼ "

Box Metal

Copper	1 lb.
Tin	1¾ oz.
Zinc	¼ "
Lead	¼ "
Antimony	1/16 "

Bell Metal

Copper	78 lbs.
Tin	22 "

The Season Cracking of Brass

Summary of Paper Presented at the Annual General Meeting of the Institute of Metals Held in London on Wednesday, March 9, 1921

By H. MOORE, O. B. E., B. Sc.; S. BECKINSDALE, B. Sc., and CLARICE E. MALLINSON, M. B. E., B. Sc.

Among the important conclusions are the following:

Season cracking occurs in a great variety of industrial brasses, differing widely in composition, degree of purity, microstructure, and physical properties, but occurs only in material which is maintained in a state of stress, either by external constraint or more commonly by internal stress.

Corrosion of the surface and sometimes of the walls of the cracks is frequently associated with season-cracking, but corrosion effects are not always visible.

Season-cracking may occur in brass coated with continuous protective layers such as lacquer, though nickel-plating is probably completely effective in preventing season-cracking, if a sufficient and continuous coat of nickel is secured.

Highly-stressed articles, capable of developing season-cracks in certain conditions, may be kept for years in reasonably pure atmosphere without showing any sign of cracking, and there appears to be no reason to anticipate the development of cracks so long as the condition of the surrounding atmosphere does not change.

Some agency additional to the presence of initial stress appears to be necessary for the development of season-cracks.

Surface defects do not appear to contribute to the development of season-cracks in brass to any important extent and corrosion does not necessarily favor their development.

Mercury, ammonia, and ammonium salts readily produce cracks in brass which is sufficiently stressed in tension. It is probable that traces of ammonia in the atmosphere are an important agency, and possibly the main agency, inducing season-cracking of stressed brass.

Season-cracks almost invariably follow an inter-crystalline path, and the cracks produced in stressed brass by mercury or by ammonia are of the same intercrystalline type.

Ammonia appears to have a specific and selective action upon the intercrystalline material of brass, weakening it sufficiently to cause the cracking if in tension. Mercury has a similar intercrystalline weakening action.

The greater the degree of hardening by cold work the less is the brass affected by the intercrystalline weakening action of ammonia or mercury, although it is probable that weakening may occur whatever the degree of hardness of the brass.

It is probable that the behavior of a copper alloy submitted to the combined effect of tension and of ammonia or mercury is a reliable index of its liability to fail by season-cracking. This liability appears to diminish as the zinc content of the brass s reduced. Copper and zinc-copper alloys containing less than about 10 per cent of zinc are unlikely to fail by the development of season-cracks in service.

A suitably controlled low temperature annealing which will remove stress sufficiently to ensure freedom from season-cracking with little or no effect on the hardness appears to be the most effective safeguard against failure by season-cracking and might well be applied to all brass articles made by cold-work operations capable of inducing permanent internal stress.

This study of season-cracking and of the action of mercury and ammonia on stressed brass affords strong support to the hypothesis of an intercrystalline material differing essentially in its properties from the crystals themselves. For example, in a pure alpha-brass the intercrystalline material appears to be attacked by ammonia or by mercury much more raidly than the crystals. The presence, on spun cups and on other cold-worked articles, of a layer which retards the intercrystalline weakening action of both mercury and ammonia, is an interesting confirmation of the view that the intercrystalline material is similar in its properties to the amorphous film produced by surface flow.

The undoubtedly intercrystalline character of season-cracks in brass appears to be fully explained by the selective weakening action of a chemical substance on the intercrystalline material. The authors are unable to find in the results of their work any evidence indicating that season-cracking is the result of viscous flow of the intercrystalline cement. In this particular their view of season-cracking in brass differs from that of Rosenhain and Archbutt, although there is agreement insofar as their explanation is also based on the assumption of an intercrystalline material probably identical in its properties with Beilby's amorphous phase found in surface films.

BELT TIGHTENERS*

In a recent number of a prominent trade paper I found this paragraph:

"While some mechanics claim they prefer cross-belting to straight belting on a drive, because it gives a little more lap around the pulley, this is really a false idea. If more lap around the pulley is desired, a tightener offers the better way. The only excuse for crossing a belt is to get a reversal of direction in the drive. Purposely to design equipment for a cross-belt, on the theory that it drives better than a straight one, is not good practice."

This is true enough, but I take exception to the sentence, "If more lap around the pulley is desired a tightener offers the better way." A tightener means that the belt is to be tighter. That is wrong. Tight belts should not be tolerated.

If an idler is used—which is usually merely another name for a tightener—increased lap may be attained, but even then the belt will be somewhat tighter.

The cost of the idler, also, should be considered. Why buy a new idler when the problem can be solved by simply using larger pulleys? Larger pulleys mean "Smaller and less expensive belts." The belt speed will be higher, of course, but that is not liable to make any serious difference, so long as the speed is not over a mile a minute.

I know of one case, for example, where a belt tightener costing $500 was installed to make a larger drive belt slipless. It gave trouble from the start in causing the pulley bearings to heat and so the engineer began looking around for some other solution. He was advised by one salesman to treat the belt, make it soft and pliable with a belt treatment, make the belt run slack and easy, and eventually he could remove the tightener entirely.

The engineer followed the salesman's advice, treated the belt, found that he could gradually relieve the tightener load and in due time removed the tightener altogether. For a few cents, in other words, he could have saved the $500 spent for the tightener.

W. F. SCHAPHORST.

Platers' Wrinkles

A Revision of the Old Edition of the Booklet with Many Additions—Part 1

Written for The Metal Industry by CHARLES H. PROCTOR

The several editions of Platers' Wrinkles that have been found necessary during the past few years prove that this little practical work has made for itself an enviable position in the plating industry.

In this revised edition basic formulæ for a number of solutions have been included, and also considerable additional data to bring Platers' Wrinkles up to date. —Ed.

Nickel Solutions

Formula for nickel solution for still tanks; for barrel plating the proportions may be increased to twice the amount as compared with water:

Water	1 gallon
Single Nickel Salts	8 ozs.
Boracic Acid	1 "
Sodium Chloride	½ "
Epsom Salts	1 "

For heavy white deposits of nickel upon Gray Iron or Steel:

Water	1 gallon
Single Nickel Salts	10 ozs.
Nickel Chloride	2 ozs.
Boracic Acid	2 ozs.
Sal Ammoniac	1 oz.
Epsom Salts	1 oz.

If one ounce of nickel fluoride is added it will stabilize the solution, give a bright deposit and prevent burning, unless an excessive current is used. All metals can be plated in the solution except zinc and die castings.

Solutions for zinc and die castings:

Water	1 gallon
Double Nickel Salts	8 ozs.
Common Salt	4 ozs.
Epson Salts	1 oz.
Sodium Citrate	2 ozs.

Water	1 gallon
Single Nickel Salts	6 ozs.
Double Nickel Salts	2 ozs.
Common Salts	2 ozs.
Sodium Citrate	3 ozs.
Epsom Salts	1 oz.

Voltages required—salt solutions, 3 to 4½; mechanical, 8 to 10.

Nickel chloride is a very good addition agent. If single salts are added and occasionally half an ounce of nickel chloride per gallon of solution the nickel solution will give excellent results and other materials that are frequently added can be omitted.

When a nickel solution produces dark tones, it is deficient in nickel unless a copper salt of some form has been accidentally added.

Salammoniac or common salt added to a nickel bath in the proportion of 2 ounces to the gallon will oftentimes bring up a white color to the deposit when other methods fail.

If at any time sulphuric acid has been added to a nickel bath in excess it is well to remember that 3 ounces of 26 per cent water ammonia will neutralize 1 ounce of 66 per cent sulphuric acid.

In plating novelty work a small addition of gelatine or transparent white glue will give an exceedingly bright lustre to the nickel deposit, providing the deposit is not too heavy. Gum tragacanth and gum arabic may also be used but in very small proportions (less than one grain per gallon of solution).

Cadmium is also being used to a great extent, preferably in the metallic form as anodes. The dimensions are usually ⅝ inch diameter and 9 inches long. Several of them are used on the anode poles with the nickel. When the deposit becomes dull the cadmium anodes should be hung in the solution for one or two hours until the deposit becomes bright. Then remove and repeat when necessary.

Nickel fluoride will be found more satisfactory to add to regular nickel solutions than hydrofluoric acid. One ounce may be used per gallon. It stabilizes the solution and gives brighter nickel deposits.

The voltage for black nickel solutions should not exceed one volt. Less is preferable. Otherwise gray tones will result. The solution works best neutral or slightly alkaline. Some platers use one or more brass anodes with the nickel anodes. They claim the small amount of copper and zinc reduced gives a much better black.

Rolled sheet nickel anodes of about 16 Brown and Sharpe gauge in thickness are used extensively in connection with gold and silver anodes in the baths of these metals. Platers that use them claim to obtain brighter and harder deposits than when gold or silver anodes are used exclusively.

To keep your baths up to their full working capacity, every other evening add ½ oz. of single sulphate of nickel to each gallon of solution and once a week, preferably on Saturday, add ½ oz. of salammoniac to each gallon; or replenish once a week and add 1 oz. single sulphate of nickel, ½ oz. chloride of nickel and ¼ oz. nickel fluoride.

When nickel solutions are in good working condition it is easy to maintain them in that condition, even when worked constantly during the day. The amount of nickel deposited is not entirely replaced by the anodes even when as much anode surface is exposed to the action of the bath as can be conveniently placed upon the supporting rods.

In preparing black nickel baths from nickel salts, salammoniac and sulpho-cyanide of sodium are used. A deeper and richer black can be produced by adding ½ oz. carbonate of copper dissolved in 1 oz. of 26 per cent ammonia water to each gallon of solution and using anodes of sheet brass instead of the usually prescribed nickel anodes. The color is obtained more rapidly and will color very satisfactorily with a soft buff.

Ten ounces of single sulphate of nickel added to each gallon of solution will accomplish better results than a pound of the double nickel salts. To maintain a nickel solution in constant operation, add only the single sulphate of nickel. The single sulphate of nickel dissolves

very readily, especially in boiling water, and contains 50 per cent more metal than the double sulphate of nickel and ammonia, therefore enriching the bath with metal proportionately to greater extent.

If a nickel deposit stains very readily it denotes that the solution is radically alkaline. Boracic acid is highly recommended for acidulating nickel baths, but for many baths, chemically pure sulphuric acid is just as good and oftentimes better, and very much cheaper. For a one hundred gallon bath dissolve in water 10 ozs. of the acid and add to the bath at the close of the day's work, stirring thoroughly. Hydrofluoric or hydrochloric acid may also be added upon the same ratio with excellent results. The solution will be found to have cleared by morning and the staining will be overcome.

Stains are sometimes produced upon nickel deposits by contaminated rinsing waters, or by drying out in sawdust that has become sour. One of the best aids to drying out nickel or any other deposit and to prevent stains is the old-fashioned plater's compound, called whale oil soap, on account of its fishy smell, 2 ozs. of this material dissolved in each gallon of boiling water will act as a dryer. Water will completely run away from the surface of the articles, thus saving labor and much sawdust.

It is very often necessary to produce a black nickel deposit upon brass, copper or bronze goods for antique relief effect, also a good bright black with a polished surface. The simplest are sometimes the best. This finish can be produced in a few minutes. Dissolve 14 ozs. of powdered white arsenic in one-half gallon of boiling water, containing 8 ozs. of powdered caustic soda. When cool add one-half gallon more water, containing one-half ounce of cyanide of sodium. Use anodes of wrought iron. On bright surfaces a bright deposit is produced. Use the same current strength as usually used for a nickel bath.

A good method to pursue in using up parts of old nickel anodes is as follows: Procure an iron rod of not less than one-quarter inch diameter, bend one end in the form of a hook, at the other end cut a thread so that a washer and nut can be used, drill holes in the pieces of anodes, and then place them on the iron rod. When sufficient has been placed upon the rod, put the washer and nut in place; coat them and also the part of the rod exposed to the action of the solution with a litle asphaltum varnish, which will prevent corrosion. This method does not expose much surface, but it is a good way to use up old pieces of anodes that would have to be sold for less than half price.

In nickel plating plumbers' hardware and other classes of goods of the cast, brass or bronze variety, especially if tin is used in their composition, the nickel deposit frequently peels from the surface; although upon articles made from sheet metal this result is not experienced in the use of the same bath. The operator looks for the cause of the trouble. Sometimes he discovers it, oftentimes not. Tin is used in the composition of the metal to produce sounder castings. When such articles are cleansed, after polishing by potash solutions or their combinations, especially in boiling solutions, an oxide of tin is produced upon the surface of the article by the action of the alkalies. This is not always noticeable; but yet it is sufficient to prevent the true adhesion of the nickel deposit.

Cyanide of sodium, unless unusually strong, will not remove it. A 2 or 3 per cent solution of muriatic acid in water will be found valuable in many cases for reducing slight oxidations very quickly, when due to tin oxide.

The pitting of nickel deposits is usually caused by a deficiency of metal in solution, or too much free acid; either case produces an excess of hydrogen gas upon the articles which appears to burn into the surface of the deposited nickel producing pitting. The remedy is to add nickel sulphate 2 or 3 ozs. to the gallon if caused by deficiency of metal. If caused by too much free acid, add carbonate of nickel; this is best added in the plastic form. Plastic carbonate of nickel is produced in the same manner as plastic carbonate of copper from copper sulphate by adding two pounds of carbonate of soda to each gallon of sulphate of nickel dissolved in boiling water. After precipitation filter carefully and rewash with hot water several times. One-half to one ounce of plastic nickel carbonate will usually overcome the free acid in a nickel bath unless added in excess. Nickel chloride and also nickel fluoride have been found to be excellent factors in reducing pitting. The chlorine liberated combines with the hydrogen and reduces it to the respective acids. Half ounce or more should be added per gallon of solution. Repeat as required.

The peeling of nickel deposits is not always due to imperfect cleaning, imperfect removal of oxides, free acid, or free alkali in solution, but to a lack of conducting salt. This can be remedied by the addition of common salt, salammoniac, sulphate of ammonia, epsom salts or nickel chloride. When the conductivity of a nickel solution is poor dark lines will be found covered by the supporting wires or frame. A stronger current applied will not make matters any better. A conducting salt is needed, 1 or 2 ozs. of which, added to each gallon of solution, will overcome this difficulty. Nickel solutions very seldom need a conducting salt; when once prepared, they do not decompose very readily, so remain quite constant. Some anodes are very hard, especially those cast in chilled moulds and do not reduce readily; any disturbance then noted, unless the bath had become contaminated with some foreign substance, would be due to a lack of metal in solution.

The difference in temperature between Summer and Winter has a very decided effect upon nickel solutions. A bath may work very well all through the Summer and Fall, but as cold weather approaches the work does not come from the bath satisfactorily, oftentimes dark or grayish, and in some cases peeling results. The solution oftentimes deposits crystals on the anodes or tanks under such conditions. This is because the salts are less soluble at the lower temperature.

If you have live or exhaust steam this trouble can be very easily overcome in the following manner: Procure a lead pipe with not less than a half-inch aperture, connect this with your regular steam pipes with valve connections. Have the pipe sufficiently long so that it can be immersed in the bottom of the tank and come up on the opposite side and then on the outside of the tank so that the condensed steam can run into a pail or other receptacle. Have a valve connection on the outlet also, so that the steam can be controlled. In very cold weather if the steam is allowed to pass through the pipe for fifteen minutes the temperature of the solution will be raised to the normal (70 degrees), thus overcoming the difficulties noted.

Hot nickel solutions are being used to an advantage especially upon plain metal surfaces. The temperature ranges from 100 degrees to 160 degrees Fahr. However, hot solutions must contain more metal than normal solutions. Agitation, both mechanical and by air pressure is necessary when high currents are used to prevent hydrogen occlusion.

The formula for such solutions should approximate as follows:

Water	1 gallon
Single Nickel Salts	1½ to 2 lbs.
Boracic Acid	3 to 4 ozs.
Common Salt	1 to 1½ "
Epsom Salts	1½ to 2 "
Nickel Fluoride	1 to 1½ "

When a very hard nickel deposit is required, yet adherent and ductile, cobalt chloride should be added to the nickel solution; one-half ounce to one ounce per gallon of solution will give the desired results. Repeat at stated intervals in combination with single nickel salts.

BRASS, BRONZE AND COPPER BATHS

Formula for still solutions. For barrel or mechanical plating the proportions given may be increased to twice the amount. As a rule for mechanical solutions the sodium cyanide and conducting salts will have to be increased by 25 per cent above amounts given for still solutions, even though the proportions of the basic formula have been doubled.

Copper Solution, Alkaline

Water	1 gallon
Sodium Cyanide	4½ ozs.
Copper Cyanide	4 "
Bicarbonate of Soda	¾ "
Bisulphite of Soda	½ "

Copper Solution Acid

Water	1 gallon
Copper Sulphate	1¾ lbs.
Sulphuric Acid, 66%	4 ozs.
Powdered Alum	1 oz.

Dexterine, Transparent Glue, and Iron Syrup, may be used as additional agents in proportions of ⅛ oz. per gallon or more.

For brightening purposes 1/32 ounce hyposulphite of soda may be added.

Bronze Solution

Water	1 gallon
Sodium Cyanide	4½ ozs.
Copper Cyanide	3¼ "
Zinc Cyanide	¾ "
Bicarbonate of Soda	½ "
Bisulphite of Soda	½ "

Brass Solution

Water	1 gallon
Sodium Cyanide	4½ ozs.
Copper Cyanide	3 "
Zinc Cyanide	1 "
Bicarbonate of Soda	1 "
Ammonium Chloride	½ "

If the anodes coat over in the brass solution with a basic zinc oxide, then very small proportions of caustic soda should be added to the solution, but not more than ⅛ ounce per gallon at one time. Repeat at intervals until the anodes clear up.

As a brightening agent one grain of powdered white arsenic dissolved in double its weight of caustic soda and a little warm water should be added per gallon of solution at intervals of one hour or more until the brass deposit becomes clear and bright. An excess of arsenic is always detrimental.

Anodes for the respective solutions should be alloyed as follows: Copper, 99 per cent copper, 1 per cent zinc. Bronze, 90 per cent copper, 10 per cent zinc. Brass, 80 per cent copper, 20 per cent zinc. Cast anodes give the best results.

Quite frequently brass or bronze solutions become sluggish and will not give uniform results even when several agents are added to increase their activity. When such results develop, reduce the solution with water at least one-third, add small proportions of sodium cyanide and as a rule the solutions will become normal again. The solution removed may be heated to 180 to 200 degrees Fahr., and metal cyanides added to increase the metal content. Then use as a stock solution for replenishing.

A little water of ammonia or sal ammoniac added to a brass bath will frequently clear the deposit, especially when muddy, thus avoiding the use of arsenic.

In plating cast iron, if the deposit peels, or is not clear, add one or two ounces of bicarbonate of soda or one or two ounces of bisulphite of soda to each gallon of solution.

In bronze plating considerable arsenic can be used in the bath to produce a satisfactory color; this gives a similar color to the deposit as tin does in the cast bronzes of the foundry.

A copper solution, containing one-eighth ounce or less of zinc in each gallon of solution, will produce a better and brighter deposit. If the bath deposits a muddy color, add about one ounce of hyposulphite of soda per 100 gallons of solution. Repeat if necessary.

Bronze baths, also brass baths when made up new, are best prepared, first as a copper bath, and then a concentrated solution of zinc cyanide in sodium cyanide, one part of the former to three-quarters part of the latter, added until the desired color is obtained. To each pound of zinc cyanide used add 1 ounce of caustic soda.

Ammonia or arsenic should not be added to a copper bath if dark or peeled deposits are to be avoided. A little bisulphite of soda will be found good practice. This acts as a conducting salt as well as forming cuprous sulphite in solution, which is readily soluble in the cyanide and produces a softer deposit and cleaner anodes.

Avoid adding too much arsenic to a brass solution, for grayish tones are produced. It will be found impossible to produce a rich lustre by the acid dips when much arsenic is contained in the brass deposit. Oftentimes a brass deposit, when acid dipped, will save considerable labor in scratch brushing, especially in gilded finishes, where a rich background is necessary.

The metal cyanides should always be used in preparing silver, copper, bronze and zinc solutions whenever possible. Any metal salt dissolved in cyanide automatically becomes converted to the metal cyanide. Sodium salts when required for conductive purposes can be added more economically and efficiently as separate factors.

These Wrinkles will be continued in later issues.—Ed.

Electro-Deposition as a Repairing Process

Remarkable Experiences in European War Workshops—Part 2*

Written for The Metal Industry by Our British Correspondent

The subject of lead deposits appears to have been very carefully considered.

Two electrolytes are recommended.

(1) The silico-fluoride solution (Betts process).

(2) The fluoborate solution.

Satisfactory deposits, said the American committee, can be produced from either electrolyte, but they recommended chiefly the fluoborate for the reasons:

(1) Of its ease of preparation.

(2) It enables deposits to be plated on steel direct without intermediate coppering.

The solution is worked at normal room temperatures at an E. M. F. of from 1 to 2 volts, rather less than more, and a C. D. of 10 to 20 amperes, if electrolyte is stagnant, 20 to 30 if agitated.

Small additions of glue are required from time to time to prevent "treeing" of deposits.

Some experimental work was also carried out on deposits of zinc, and I give on the screen an advised formula:

Zinc sulphate	2 pounds
Magnesium sulphate	4 ounces
Boric acid	4 "
Water	1 gallon

Zinc cyanide	10 ounces
Sodium cyanide	5 "
Sodium hydroxide	6 "
Aluminum sulphate	2 "
Water	1 gallon

The committee definitely recommended that for protection of iron and steel against atmospheric corrosion only zinc coatings should be employed.

Lead plating was used only where protection against corrosive liquids was necessary. The following fluoborate solution was recommended:

40% hydrofluric acid	2 pounds
Boric acid	12 ounces
White lead	1 pound
Glue	.025 to .050 ozs.
Water to make up to	1 gallon

The salt spray test has been adopted for testing the deposits of both lead and tin.

Our first interchange of reports and communications with the American committee occurred towards the end of October, 1918, and this proved to be the last, for on November 11 Armistice was proclaimed, and the Electro Metallurgical Committee, like so many other war organizations, came to an end.

Its life at most only covered about eight months, but as one reviews its work, one realizes that considerable results were obtained, and certainly a foundation laid upon which very much more work might have been built.

In his reply, after discussion, Mr. Barclay said that one of the earliest of his experiences in France was to advise those concerned that iron was very much superior to copper for any of the purposes they had in view. Copper was widely used for other purposes, but for the purposes in question it was much too soft. The use of ferrocyanide in brassing solutions was Mr. Price's own invention, and he thought it might be generally accepted. There was really no theoretical reason for or against it, and one certainly did find the addition of some of those salts to produce a good effect by increasing the conductivity. He listened to the remarks of Mr. Spittle, for which he was very grateful, with some degree of self-reproach for not having dealt at greater length with the actual results. But he had been afraid of making his paper too long, and, as a matter of fact, there was no necessity for him to deal with that part, because as most of his work was done at home he was not in a position to judge whether the work was a success or not. He had only dealt with the technical investigations. Recently, however, a paper was given by the works manager of the Third Repair Shop to the Institution of Automabile Engineers, which dealt with the working experiences of this shop. From this paper it appeared that over a period of about fifteen months over 6,000 parts were reclaimed in this shop only by this method, and the author states that:

"In very many cases the car has come back to the shop after a period of use sufficient to make a complete overhaul again necessary, and it has been possible to examine the behavior of the deposits under severe conditions. Such examinations have affirmed the view that the deposited parts should stand up perfectly satisfactorily in service."

That also was confirmed by a written communication from the officer in charge of the Depositing Shop at St. Omer, who said that there were a number of cases in which the deposited parts had actually stood up better than new parts of standard design. One of the difficulties with regard to a new process or method was that people got an exaggerated view of what might be done. An enormous number of suggestions were sent to his committee by people who had heard of the possibilities of the new process, and some of these suggestions were of a most marvellous character. For instance, they were asked to deposit in a 12-inch howitzer a lining of iron which would stand the firing test. As this would involve the covering of the internal face of a cylinder having a length of 5 ft. 6 inches and a diameter of 12 inches, those acquainted with the subject could imagine what a task it would be in the present state of our technical knowledge. The results of what had been attempted, however, were such as to show that there were great possibilities in the process so long as it was not required to do more than could be reasonably expected. From his own experience he believed that it would prove an exceedingly valuable adjunct to engineering work, but that its applications had limits. With regards to the remarks of the chairman (Dr. Brownsdon), he was very much interested in the perchlorate bath when it was introduced. He had known it gives very good results, and, consequently, had included it in his text-book on electro-plating, published in 1912. But, according to the report of the American committee, the perchlorate bath had not been very successful in commercial practice, and the fluoborate bath was recommended. As the Americans had had much more experience than he had in this matter, he thought he must accept their recommendation.

Mr. Barclay then handed round a number of interesting samples of electro-deposition in illustration of his paper, one of them being an experimental tube coated to a depth of nearly half an inch.

*Part 1 was published in our March issue, page 117.

Metal Plating

Part 9.—Iron Plating. A Tabulation Showing the Time Required to Deposit a Given Thickness of Iron with Different Values of Current Density—Some Remarks Relative to Important Factors for Control of Iron Solutions and of the Character of the Deposits Are Also Given*

Written for The Metal Industry by W. G. KNOX, Associated with the Chemical Laboratories of the Western Electric Company

Iron obtained electrolytically from a solution of its salts is becoming of increased importance as the advantages to be gained through the use of high purity material are better understood.

A few years ago the principal uses for electrolytic iron were for the experimental preparation of special alloys and for conversion into certain pure iron salts used in medicinal preparations. Since these early experimental trials were made, new fields have opened up for this pure iron. Today the material is manufactured on a large scale for use in alloy production, in the electrical industry for use in transformer cores, etc., on a smaller, but not less important scale in electro-typing as a hard protective coating or facing for the copper electro-types. Electro-deposition has also been proposed as a possible method to be used in building up sections of various iron parts which have become reduced in size through wear. This latter process has been tried out, but until a short time ago, was not sufficiently developed to prove of much interest commercially. However, with further advancement in the art of plating iron, it may yet prove of considerable importance in this field.

Electrolytic iron may be deposited from a solution of its salts alone or in combination with other salts in a number of proportions. For the benefit of those who might be interested in this subject but who may not have had time to examine the literature, it is recommended that they look up the following references:

1. C. F. Burgess and Hambuechen. Trans. Amer. Electro-chem. Soc. 5, page 201, 1904.

2. Kern, Trans. Amer. Electro-chem. Soc. 3, page 103, 1908.

3. Preparation of pure iron and iron-carbon alloys. U. S. Bureau of Standards paper No. 266, Feb. 29, 1916.

There is also a very interesting series of pictures of electrolytic iron by Oliver W. Storey in the Trans. Amer. Electro-chem. Society, Vol. 25, 1914.

Some of these references give considerable information regarding the composition of iron electrolytes and the records of a number of tests carried out on these electrolytes.

Either the ferrous-ammonium sulphate bath recommended by Dr. Burgess or the ferrous-sodium chloride bath of the Bureau of Standards should give satisfactory deposits of iron if they are worked in a careful manner. These baths are probably the best known of those in use today, but possibly there are others which are equally good. On account of the tendency of the ferrous solutions to form basic salts rapidly even under conditions of careful control, it is necessary to use some means occasionally to remove the insoluble residue from the bath, in order to obtain smooth coatings. Filter bags, porous plates or jars, continuous filtering devices or other media may be used.

ANODES

The anodes used in connection with the deposition of iron may be of any commercial grade, but ingot iron probably would be more satisfactory because of its purity. Iron anodes are quite similar in their behavior under electrolysis to zinc or nickel anodes, since they form considerable scale or insoluble coatings over the surface. This scale or loose insoluble material should be removed at frequent intervals. As a result of the formation of basic salts in the solution and of scale on the anodes, greater care will be required to keep an iron solution in good condition than nickel or zinc solutions.

Regarding the solubility of the iron from the anodes, it is said that the presence of hydrogen and chlorine ions and warm or hot solutions are favorable factors.

CURRENT DENSITY

The current density to be used in depositing iron will depend largely on the character of the coating desired and on the character and density of the solution. Excellent deposits may be obtained at 20 amperes per square foot under certain conditions of temperature and solution density, but usually the current density is somewhat lower than this. For average thicknesses, such as are shown in the attached table, a current density of 8-12 amperes should give very good deposits.

NATURE OF DEPOSIT

There are several factors which appear to exert considerable influence upon the nature of the deposit due to the effect of absorbed or dissolved hydrogen. Hydrogen in the deposit is increased with:

(1) Increase of iron in the electrolyte.
(2) Decrease of acid in the electrolyte.
(3) Increase of current density.

It is decreased perceptibly with an increase in temperature and is equalized considerably by rapid circulation or diffusion of the solution. Regarding the temperature effect on the solubility of hydrogen, "Allmand" gives the following figures—at 18° deposited iron contained 0.085 per cent. H; at 37°, 0.039 per cent.; at 55°, 0.024 per cent., and at 75°, 0.0096 per cent. At lower temperatures than 18°, particularly 10°-12°, it appears almost impossible to obtain, except with very thin coatings, a smooth continuous deposit. The coating checks, cracks, curls up and usually flakes off. This should be interesting in connection with electro-typing work. With higher temperatures (40°-50°) the deposits contain approximately fifty per cent. less dissolved hydrogen than that produced at 18° and consequently is softer and more ductile. It also adheres to the starting sheet much better.

CURRENT EFFICIENCY

"Allmand" further states that satisfactory current efficiencies are obtained with:

(1) High iron (Fe) concentration.
(2) High current efficiency.
(3) High temperature.
(4) Hydrogen (H) concentration only high enough to prevent precipitation of basic salts.

PURITY OF ELECTROLYTIC IRON

The purity of electrolytic iron depends materially upon the care used in maintaining the solution from which it is deposited as well as properly observing the general control features of the process.

For the purpose of illustration, an analysis of a good electrolytic iron is given herewith. This analysis will show the extremely high purity of iron which it is pos-

*Parts 1 to 8 inclusive were published in THE METAL INDUSTRY, June, 1919, August, 1919, January, April, June, August, December, 1920, and January, 1921.

TIME REQUIRED FOR A THICKNESS IN INCHES OF IRON. (DIVALENT)
CALCULATED ON THE BASIS OF 100% CATHODE EFFICIENCY
HOURS MINUTES AND SECONDS

CURRENT DENSITY

AMPERES PER SQ. FOOT	AMPERES PER SQ. INCH	.0001	.00002	.00003	.00004	.00005	.00006	.00007	.00008	.00009	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009	.001	.002
1	.007	10 30	21	.32	.42	.53	1 03	1:14	1.24	1:35	1:45	3:30	5:15	7:00	8:45	10:30	12:15	14:00	15:45	17:30	35:00
2	.014	.05 15	.10 30	:16	.21	.27	:34	.37	:42	.48	53	1:45	2:38	3:50	4:23	5:15	6:08	7:00	7:53	8:45	17:30
3	.021	03 30	.07	:10 30	:14	:18	:21	25	:28	.32	:35	1:10	1:45	2:20	2:55	3:30	4:05	4:40	5:15	5:50	11:40
4	.028	.02 30	.05 15	.07 [illegible]	.10 30	:13	16	:19	.21	24	.26 30	.53	1:09	1:46	2:12	2:38	3:05	3:32	3:59	4:24	8:48
5	.035	.02 06	.04 12	.06 18	.08 24	.10 30	:13	:15	:17	:19	.21	42	1:03	1:24	1:45	2:06	2:27	2:48	3:09	3:30	7:00
6	.042	.01 53	.03 59	.05 45	.07 30	.09 36	.10 30	14	.16	.17	.19	.39	.58	1:17	1:36	1:55	2:14	2:34	2:53	3:12	6:24
7	.049	.01 30	.03	.04 30	.06	.07 30	.09	.10 30	.12	.14	.16	.31	.47	1:02	1:18	1:39	1:49	2:04	2:20	2:35	5:10
8	.056	.01 19	.02 38	.03 57	.05 16	.06 35	.07 54	.09 13	.10 30	.12	.13	.27	.40	.53	1.06	1:19	1:32	1:46	1.59	2:12	4:24
9	.063	.01 10	.02 20	.03 30	.04 40	.05 50	.07	.08 10	.09 20	.10 30	12	:24	.35	:47	:59	1:10	1:22	1:34	1:45	1:57	3:54
10	.070	.01 03	.02 06	.03 09	.04 13	.05 16	.06 18	.07 21	.08 24	.09 27	.10 30	.21	.32	.42	.53	1:03	1:14	1:24	1:35	1:45	3:30
15	.105	.00 42	.01 24	.02 06	.02 46	.03 30	.04 13	.04 54	.05 36	.06 18	07	:14	:21	.28	:35	:42	:49	:56	:63	1:10	2:20
20	.140	.00 32	.01 03	.01 34	.02 07	.02 39	.03 11	.03 43	.04 13	.04 45	.05 15	:11	:16	.21	:27	:32	:37	:42	:47	:53	1:46
25	.175	.00 24	.00 50	.01 15	.01 40	.02 04	.02 30	.02 55	.03 20	.03 45	.04 10	.08 20	:13	.17	:21	:25	:29	:34	:38	:42	1:24
30	.210	.00 21	.00 42	.01 03	.01 24	.01 45	.02 06	.02 27	.02 48	.03 09	.03 30	.07	.10 30	.14	.18	.21	.25	.28	.32	.35	1:10
35	.245	.00 18	.00 36	.00 54	.01 12	.01 30	.01 48	.02 06	.02 24	.02 42	.03	.06	.09	.12	.15	.18	.21	.24	.27	.30	1:00
40	.280	.00 16	.00 33	.00 48	.01 03	.01 20	.01 36	.01 52	.02 08	.02 24	.02 40	.05 20	.08	.10 40	.14	.16	.19	.22	.24	.27	.54
45	.315	.00 14	.00 28	.00 42	.00 56	.01 10	.01 24	.01 38	.01 52	.02 06	.02 20	.04 40	.07	.09 20	.12	.14	.17	.19	.21	.23	.46
50	.350	.00 13	.00 26	.00 39	.00 51	.01 03	.01 16	.01 29	.01 41	.01 54	.02 06	.04 13	.06 18	.08 24	.10 30	.13	.15	.17	.19	.21	.42
GRAMS PER SQUARE INCH		.0013	.0026	.0039	.0051	.0064	.0078	.0090	.0103	.0115	.0128	.0256	.0384	.0512	.0640	.0768	.0896	.1044	.1152	.1280	.2560

ATOMIC WEIGHT OF IRON.....55.85
SPECIFIC GRAVITY OF IRON.....7.8
ELECTRO-CHEMICAL EQUIVALENT OF IRON....0.00290

NOTE – TIME BELOW 11 MINUTES GIVEN IN MINUTES AND SECONDS, 11 MINUTES AND ABOVE GIVEN IN HOURS AND MINUTES.

TABLE SHOWING RATE OF DEPOSITION OF DIVALENT IRON

sible to produce under favorable conditions by the electrolytic method. These figures were taken from a pamphlet (No. 266) issued by the Bureau of Standards.

Carbon	.004%	Silicon	.005%
Sulphur	.004%	Copper	.008%
Phosphorus	trace	Nickel and cobalt	.010%
Manganese	trace	Iron (by diff.)	99.967%

APPEARANCE OF HEAVY DEPOSITS

As a matter of interest two photographs of a heavy deposit of iron are shown below. These deposits were made from a two months' old solution and represent continuous deposition for a period of approximately two weeks at about 10 amperes per square foot. The deposit is very dense, although it is somewhat rough on

the surface, due mainly to the adherence of gas bubbles formed during the latter stages of deposition. No 1 is a view showing the general appearance of the surface; No. 2 is a cross-section view showing the thickness and density of the deposit.

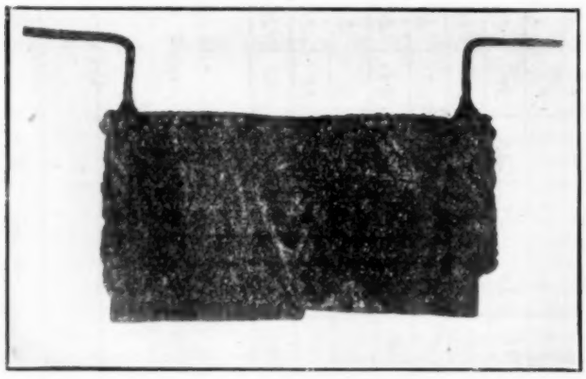


FIG. 1. SURFACE APPEARANCE OF HEAVILY DEPOSITED IRON.

Light deposits of iron do not exhibit the surface effects shown in the above picture but rather resemble in appearance that of zinc and cadmium. In other words, light deposits of iron may be produced just as smooth and even as any of the other electro-deposited metal coatings.

In addition to the careful manipulation required in depositing iron, certain precautions in handling the finished product upon removal from the bath are equally important. We are all familiar with the rapidity with which iron rusts and electrolytic iron is no exception to the rule, although it is exceedingly pure. The corrosion of the latter may in some cases proceed quite rapidly, largely due, it is said, to the presence of the hydrogen and to chlorides. Smooth dense coatings, particularly the thin deposits on small objects are not as troublesome as heavy and usually rough commercial deposits. Small work may be removed from the plating solution,

FIG. 2. CROSS SECTION OF HEAVILY DEPOSITED IRON.

washed and dried quickly. As a further means of protecting and preserving these deposits, they should be either oiled or lacquered.

The table shown herewith includes calculations for thickness up to .002". It is a comparatively simple matter to extend these calculations to cover thickness of .1" or more if required. As with many of the previously published plating tables, the cathode efficiency is considered to be about 90%—hence 10% must be added to the figures of time in order to obtain approximate accuracy with actual deposits. With commercial production the efficiency will probably be somewhat lower.

Electro-Deposition and Electroplating*

Mr. G. B. Brook, F.I.C., read a paper on **"The Crystalline Structure of Electro-deposited Silver."**

The author shows that the normal relatively smooth "reguline" deposit develops, with high current density, a growth of individual acicular crystals from the face of the deposit. In the subsequent burnishing and polishing such structure results in the retention in the interstices of the imperfectly laid-down crystals of the polishing material. It was the investigation of this latter trouble, which had become serious and general in the silver trade, that the author found that very high current density contributed to the particular form of crystal growth (or its free development) and accounted for the retention of the rouge in the final process of polishing.

Mr. Byron Carr disagreed with Mr. Brook's conclusions, since:—

(i) The same effect was produced on sterling silver.

(ii) It depended on the finishing process.

(iii) If the deposit were burnished and the crystal flattened out subsequent rouging might result in red stains.

Mr. W. E. Hughes wrote that his experience did not support Mr. Brook's explanation, and he suspected sulphide as the cause of the trouble. In his case it certainly was not due to excessive current density. Moreover, he noticed the dark coloring on surfaces of varying curvature as well as in flat ware. Possibly they were dealing with two separate phenomena. He advocated more frequent use of the microscope in the plating shop.

Mr. S. Field, A.R.C.Sc., read a paper on **"The Deposition of Gold-Silver Alloys."**

A series of experiments has been carried out in order to trace the influence of varying conditions on the composition of the gold-silver alloys deposited in the well-known "green gold." In cyanide solutions gold is the more positive metal. In the absence of hydrogen deposition, the composition of the deposited alloy can be calculated from the ratio of its mass to that of copper deposited in a coulomb-meter in the circuit. In gilding solutions of normal strengths this ideally quantitative depositon is not attained. The deposits are produced on lead foil cathodes, and, after weighing, are cupelled with added silver to give a "parting" mixture from which the content of gold is determined. Platinum anodes provide the means of most constant control over the composition of the bath, additions of standard solutions of gold and silver cyanides being made after each deposit.

A cold solution containing 14.2 grammes gold and 7.2 grammes silver per litre and without free cyanide was first employed. Increased current density increased the proportion of gold in the alloy. A similar increase occurs in a warm solution but the whole of the gold values are lower than in cold solutions. Diluting the solution also increases the proportion of gold and addition of free cyanide has the same effect, the proportion of gold to silver becoming more constant and independent of other conditions with larger proportions of free cyanide.

By way of comparison, deposits were prepared in a works under normal working conditions. These included a more dilute solution with a larger gold-silver ratio and a larger proportion of free cyanide. Over a range of current density of one to five an almost constant percentage of 77 to 78 per cent of gold in the deposit was obtained.

*Conclusion of the article of the same title published in our February issue, page 75.

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EDITORIAL

THE BUSINESS SITUATION

The general tone of our correspondents throughout the country and the opinions of those whom we have met seems to indicate a turning point in the present difficulties. It seems to be the general impression that the worst is either here or over, but certainly not coming. Manufacturers report more inquiries, and that these inquiries are of better type. A few automobile factories have started and building shows a few signs of improvement. So far as actual business is concerned, the gain is slight, but a more hopeful atmosphere is evident. Men are now looking for a chance to buy well, whereas up to the last two or three weeks, they were looking for a chance to sell.

A large sale of brass cartridge cases was made by the Government which disposed of 30,000,000 pounds of old metals. The Scovill Manufacturing Company, The Chase Companies of Waterbury, Conn., and the Bridgeport Brass Company of Bridgeport, Conn., took 10,000,000 pounds each, at a price which is to be 41½ per cent of the average market price for copper content plus 19½ per cent of the average market price for prime western zinc during the month in which deliveries are made to the buyers. This sale removes a tremendous amount of material which has been hanging heavily over the market for some time.

In connection with the situation in general, it is worth noting the opinion of Roger W. Babson, the economist and statistician who in an address before the Boston City Club stated among other things the following points of importance:

1. The great mass of working people in this country still have their Liberty Bonds. It is true that corporations and many small holders have sold theirs. The great bulk of wage workers, however, still retain theirs, and they will not cease buying merchandise so long as they hold these bonds.

2. Prohibition is a great factor for prosperity, the importance of which is not fully realized. Previous to July, 1919, several billion dollars a year were being spent by people of this country for drink. About 20 per cent of this money has gone into the savings banks; but the balance has gone into building homes, buying merchandise, raising the standard of living. Whether 100 per cent prohibition has come to stay indefinitely, I do not know; but it surely must be as much of a factor for good business during the next few years as it has been during the past year and a half.

3. The Federal Reserve System is working well. It is popular to criticize the Federal Reserve Board; but such criticism is usually directed against their good acts rather than against their lax ones. The Federal Reserve System cannot expand indefinitely any more than can a rubber ball; but we have substituted an elastic system, the good results of which are bound to continue.

4. Advertising has become a great economic factor for the producing and steadying of business. The old form of advertising, which was largely of the luxury type, has been replaced by a new productive form. This new form of advertising has come to stay and could be a great factor in preventing business panics such as we have had in the past.

5. Though our foreign trade has greatly grown during the past five years, it is no greater proportion of our total trade than it ever was. If we lost all our export trade today, it would reduce our total business only about 5 per cent.

6. Standardization in manufacturing is rapidly increasing. Great improvement can still be made along these lines. The Ford system can be applied to a great many more commodities than automobiles. Concerns that used to manufacture 10,000 different articles are now doubling their capacity, but halving the number of articles they produce. All of this is along the line of efficiency and tends to continue prosperity.

7. Taxation will surely be reduced. Not only will the new administration reduce expenditures, but our system of taxation will be changed so as to encourage production rather than penalize it.

8. Modern education for executives and employes is rapidly being introduced. Industrial education is constantly growing.

SECONDARY METALS

A recent bulletin issued by the U. S. Geological Survey on Secondary Metals in 1919, by J. P. Dunlop, includes a great deal of very interesting information for the metal world. At one time this business was known by the short ugly word "junk," and was typified by the unkempt person who drove a cart with a string of bells across it. From this stage the industry has grown to a point where in 1919, the recovered metals were worth $181,841,500. It is needless to say that such an enormous business can no longer be looked down upon, because of its pettiness or uselessness. Its size is plain from the value of the metals recovered. Its usefulness is equally obvious. There is no industry more legitimate or more necessary than that which recovers what would otherwise be lost. The recovery of secondary metals is not a junk business, but a business of conservation and reclamation. The day has passed, if it ever existed, when the collector of scrap could be looked down upon for the nature of his business. The increased use of chemical analysis has stabilized it, and vastly improved relations between buyer and seller.

It is very interesting to find that those who are engaged in this work have become conscious of the importance of their contribution, and that their organization is taking its proper place.

The National Association of Waste Material Dealers has grown until it now includes considerably over three hundred members. When it is considered that these members are not individuals, but organizations, corporate and otherwise, this figure represents a very strong association. The Association operates a traffic department, credit bureau, and various divisions, which look after the interests of their specialized trades. The metal division, at its recent meeting elected H. L. Green, chairman, and Mr. Green has laid plans for an energetic campaign of development.

There is no question of the value of the Metal Division to the secondary metal industry. Every individual or company in this industry should be a member of the Association. There is much work still to do. The taint of the junk dealer still clings in places, and the business can be cleaned up only by the co-operative work in such an organization.

ELECTRIC FURNACES

In spite of the fact that business during the last six months has been weak, the electric furnace industry has made notable gains in the metal field in the past year. According to figures collected by the Iron Age, the total

number of furnaces installed in the United States for melting metals has risen from 261 to 408; foreign installations increased by about 15. New types which have shown activity in the past year are the Booth Rotating, H & H Electric Reverberatory, Von Schlegell Repelling Arc and the Ajax-Northrup Induction.

These figures shown in the table below prove, if such proof is necessary, that electric furnaces are not a fad or an overnight growth. It is very gratifying to note that we have gone further along these lines than the foreign countries, and that our furnaces are likely to lead the way abroad as well as at home. It will be very interesting to see what the reports will be for the coming year with a much worse start than 1920. A summary of types of electric furnaces installed or contracted for in the metal industry in the United States is as follows:

TYPE OF FURNACE	NUMBER FURNACES, MARCH 1, 1921	NUMBER FURNACES, MARCH 1, 1920
Ajax-Wyatt	178	118
Baily	82	61
Detroit rocking	57	44
Booth rotating	40	20
Rennerfelt	13	9
H & H electric reverberatory	1	..
Snyder	4	7
Von Schlegell	11	..
General Electric	8	..
Ajax-Northrup	11	..
Weeks	1	1
Ludlum	1	1
Greaves-Etchells	1	..
Total	408	261

During the last three years THE METAL INDUSTRY has published descriptions of all of the above mentioned types (except the Ludlum and Greaves-Etchells, which are restricted almost entirely to steel) from all points of view.

RESTRICTED IMMIGRATION

The failure of the Dillingham Bill, a restrictive immigration enactment, to become a law through the omission of the ex-president's signature, transfers to the next Congress any immediate legislation which aims to restrict the number of aliens coming to our shores.

In view of the current opinion that some sort of a measure will be presented to the new Congress, the Inter-Racial Council, which has been booming immigration, has issued a circular urging opposition to legislation which provides the limitations written in the Dillingham Bill. This bill limited the number of immigrants who could come to America in any one year to three per cent. of the race already resident in the United States; a restriction on racial lines. The contention of the Council has been, that with the usual labor shortage in normal times, we could not get along without immigrants, and that all obstacles to their coming should be swept aside. In brief, the country needed the workers for the sake of its industries.

We should say that any immigrant legislation which is presented to the next Congress, should be considered from every viewpoint, especially so far as the law affects the present and future welfare of the United States, and that political conditions should be one of the first considerations. The question is whether or not we are hurting the cause of good government by allowing a greater number of aliens to land than the country can assimilate.

The political aggression and participation in old world affairs by some of the races which come to America, with the resultant strife and misrule of many of our large cities, illustrates how, in letting down the bars ad libitum to the workers of the world in order to develop the industries of the United States, we are, as a consequence, likely to suffer in a political sense. The enlightened course would seem to be to make a thorough study of the situation, then enact such legislation as would give the United States a selected, restricted number of immigrants, and not to continue to permit the unrestricted flood of aliens, with its direful political results and oversupply of labor at times like the present, when there is not enough employment to keep at work native and naturalized citizens.

NEW BOOKS

A Dictionary of Chemical Solubilities—Inorganic, by Arthur Messinger Comey, Ph. D., and Dorothy A. Hahn, Ph. D., published by the Macmillan Company, New York. Size 5½ x 8½—1,141 pages. Price, payable in advance, $14. For sale by THE METAL INDUSTRY.

The second edition of this work, which was originally written by Dr. Comey, has just been published. The first edition was for twenty-five years a standard work on the solubility of inorganic materials. It is in almost every sense a complete dictionary of inorganic solubilities, the need and usefulness of which has always been recognized. Necessarily a book of this kind represents an enormous amount of work on the part of the authors. It is plainly impossible, of course, that any one or two individuals could perform the actual operations of testing every substance named, so the book becomes a compilation of existing literature, edited and arranged so as to show the authority for each statement and the source of the compilers' information. The alphabetical arrangement makes reference quick and easy.

Although a large part of the material lies outside of the field of the metallurgist, nevertheless, he will find it decidedly worth his while to keep it for reference since all of the material which would come under his work can be found in it. The solubilities of all analyzed inorganic substances are included. In addition the simpler carbon compounds, such as the carbonates, cyanides and ferro-cyanides are given. The compounds of metals with one of the non-metallic elements are classified under the metals.

The authors have made a thorough study of all European and American periodicals dealing with chemical research, covering the field completely. The work is encyclopedic and authoritative.

Copper Refining, by Lawrence Addicks, published by the McGraw-Hill Book Company, 370 Seventh avenue, New York. Size 6 x 9—206 pages. Price, payable in advance, $3.00 For sale by THE METAL INDUSTRY.

This book is a compilation and revision of a series of articles, originally written for Chemical and Metallurgical Engineering, which brings together, for the first time in book form, information on electrolytic copper refining. Mr. Addicks is pre-eminently fitted to write such a book because of his wide experience with copper refining. The need for literature along these lines has long been felt, and it can be said that this work takes a long step toward filling it.

It is almost entirely new and original material. The book has evidently been written as much from a managerial standpoint as from a chemical. Processes are sketched in broadly with considerable attention paid to engineering as well as metallurgical problems. Many diagrams, charts and tables are included.

The whole of the book will be interesting to the metal refiner and user, even though he may not be operating a plant on the scale that Mr. Addicks is accustomed to. The broad principles are applicable and in many cases details can also be applied. Portions of special interest are the chapters on Furnace Refining, The Requirements of Refined Copper and Copper from Secondary Material.

CORRESPONDENCE AND DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

COST OF MELTING NON-FERROUS METALS

To the Editor of THE METAL INDUSTRY:

The factors entering into the cost per pound of melting and casting non-ferrous metals of a given quality are, in order of their relative importance, as follows:

1. Labor Cost.
2. Overhead.
3. Fuel Cost.
4. Interest and Depreciation.
5. Maintenance and Repairs.
6. Supplies.
7. Metal Losses.

There are other factors to which no definite value in dollars can be assigned, but which are, nevertheless, of vital importance; for instance, versatility of the plant, by which is meant the ability of the plant to give satisfactory service both in cost and quality in the face of the constantly changing requirements of the business. A plant producing a certain line of product today may install equipment which will give very satisfactory results; at some later period the demand for this particular product may diminish and the plant is called upon to produce an altogether different line, it is then discovered that the equipment which was suitable for the original production becomes a handicap.

Another consideration of equal importance is what might be termed the "power factor" of the installation as a whole. Power factor is of importance in electrical engineering and indicates the extent to which a dynamo or motor is operating to its capacity; for example, a 500 H. P. motor driving a machine which requires only 200 H. P. is operating at a very low power factor and the cost of running the machine is therefore tremendously increased. A 2,000 lb. furnace being used for melting a 200 lb. charge is operating with an extremely low "power factor" and the cost of melting the 200 lbs. is very high. A plant might have on its books business enough to warrant the installation of say one 2,000 lb. furnace but with the always to be expected period of business depression it is likely to be necessary to reduce the production by 50% or more with the result that the furnace will be operated at a very low power factor and the cost of melting increased out of reason.

In general the larger the unit or charge to be melted the lower the cost. The larger the unit or charge employed the lower the degree of versatility and the more important the operating power factor becomes. A balance must therefore be struck between the cost of melting, the degree of versatility necessary as governed by the nature of the business, and the importance of the power factor which is to some extent governed by the cost of the installation.

The electric melting furnace is by far the most expensive installation averaging about five times the cost of a coal, gas or oil installation of the same capacity, and they cannot be made to operate economically with small charges. For this reason the considerations outlined above regarding degree of versatility and power factor, are of much greater importance with the electric furnace than they would be with a fuel fired installation on account of the greater amount of money involved.

Of the different designs of electric furnaces now available there is practically no one furnace suitable for all commercial non-ferrous alloys and casting conditions; for example, the vertical ring induction furnace is satisfactory for continuous quantity production of a standard alloy provided that the alloy has a fairly high electrical resistance and contains but a small percentage of lead. Alloys rich in copper and containing more than about three per cent lead cannot be handled. There is a resistance furnace which can be used for practically any alloy where stirring is not required and where pouring into a ladle and thence into molds is permissible, but the design of this furnace from the heat-application standpoint is very poor and excessive slagging of the lining is a constant source of inconvenience. There are still other types of rotating arc furnaces which can be used for practically all alloys but slagging and breakage of electrodes, etc., are a constant accompaniment of the commercial operation of this type of furnace.

I find, therefore, that in the plant producing a variety of alloys and where pouring is done into iron molds, the electrical installation has the following disadvantages:

1. There is no one type of electric furnace adaptable to all requirements.
2. The high cost of electric furnaces reduces the feasibility of having a unit of each type of electric furnace to suit the varied requirements.
3. The degree of versatility of the electric furnace is very low in comparison with the crucible furnace.
4. Operating power factor is likely to be very low in dull periods with a resulting increased overhead and amortization charges, etc. This may also be aggravated to some extent by the fact that as a rule in order to obtain a low rate from the power company, it is necessary to contract for a certain amount of power in given period which must be paid for whether the power is used or not.
5. High cost of auxiliary casting shop equipment. It is necessary not only to buy an electric furnace, but also to install expensive equipment either to move the furnace to the molds or the molds to the furnace by means of trolleys, turntables or cranes, etc.

I do not wish to imply that there are no conditions under which the electric furnace in one of its numerous types would be satisfactory; however, it very frequently happens that electric furnaces are installed for some one particular reason without sufficient attention being given to the many other considerations entering into the problem. The purpose of this letter has been to point out some of the factors which are likely to be ignored or glossed over. The furnace engineer rather than the furnace maker should be consulted and the whole problem given much more study than is usually the case. The use of gas and oil for brass melting offers greater possibilities than electricity, but unfortunately electrical equipment has been very widely advertised and the statements contained in the sales matter are not altogether free from exaggeration and misapprehension. For example, the many tabulations of melting costs which have been published from time to time contain much that is misleading. As one eminent authority known to the writer has said: "Figures don't lie but liars can figure."

Gas and oil equipment and processes have received but little of this advertising and the advantages and economies arising from their use are but little realized. EQUIPMENT ENGINEER.

NEW YORK, April 1, 1921.

This letter represents plainly the view of the man who favors crucibles as against electric furnaces. Many will undoubtedly disagree with him; others will be on his side. **We should like very much to have more expressions of opinion about the feasibility of the use of electric furnaces in foundries.—Ed.**

REFINISHING TABLEWARE

To the Editor of THE METAL INDUSTRY:

In reading the March issue of the METAL INDUSTRY our attention was called to the answer to problem No. 2,931 on refinishing tableware.

In answering you make a statement that a satisfactory job cannot result if the steel is badly pitted. It happens that the writer has had a case very similar to this one come under his observation.

A horizontal tumbling barrel for wet grinding was used in that particular case and it was loaded about half full of work and very fine ground quartz was used as an abrasive. After tumbling for about six hours all the pit marks were removed and the work came out of the barrel bright and smooth.

If at any time you have problems of this nature we are willing to be of whatever service we can to you.

H. C. BOOTH, The Henderson Bros. Company.

WATERBURY, Conn., March 11, 1921.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

BRASS AND COPPER BARREL SOLUTIONS

Q.—What are good solutions for brass and copper plating in barrels.

A.—In mechanical barrel plating it should be remembered that at least double the voltage is required over the still solutions to overcome the resistance developed by the rotation.

FORMULA FOR COPPER SOLUTION—MECHANICAL.

Water	1 gal.
Sodium cyanide	6½ to 7 ozs.
Copper cyanide	6 ozs.
Bicarbonate of soda	2 ozs.
Bisulphite of soda	1 oz.

Prepare the solution in the order given, using about one-third of the water at first at a temperature of 160 deg. Fahr. Dissolve the cyanide therein and the copper cyanide. Add the balance of the water, cold, then the sodium salts in the order given.

FORMULA FOR BRASS SOLUTION—MECHANICAL.

Water	1 gal.
Sodium cyanide	8 ozs.
Copper cyanide	5 ozs.
Zinc cyanide	2½ ozs.
Bicarbonate of soda	2 ozs.
Sal ammoniac	1 oz.

Prepare the solution as outlined for copper. If the anodes coat over with a white deposit showing zinc oxide, then add a very little caustic soda to the solution, beginning with ⅛ ounce per gallon and increasing the amount until the anodes become clean. Avoid an excess, for in that case the brass deposit will show an excess of zinc for a short time.

Sheet copper or brass anodes should be used, of a thickness sufficient to carry the current and stand up under continuous use. Some platers find an advantage in adding arsenic to brass solutions. They claim to obtain thereby a more uniform alloy. Do not use more than one grain of white arsenic dissolved in three grains of caustic soda per gallon of solution at any one time.—C. H. P. Problem 2,932.

DAIRY FIXTURE METAL

Q.—What are good mixtures for dairy fixtures?

In addition to the mixtures given in THE METAL INDUSTRY for February, 1921, page 86, the following can be recommended:

A.—This mixture is non-corrosive and takes a very high polish, but requires special skill in casting. However, any one familar with manganese bronze will be able to cast it successfully.

Mixture No. 1:	
Monel metal	40
Copper	44
Hardener	15
Manganese titanium	1
Mixture for hardener:	
Copper	30
Aluminum	10
Zinc	60

Melt the copper, add the aluminum, then the zinc, and pour in ingots and use as instructed.

Mixture No. 2:	
Copper	45
Monel metal	50
Tin	1½ to 2½
Thirty per cent Manganese copper	2
Aluminum	½
Manganese titanium	1¼

When a hard metal is desired, use 2½% tin; when not quite so hard 1½%. It has been found by some of the larger dairy concerns that no other metal they have tried has proven so satisfactory for valves and fittings as this mixture. It is cheap, even though the first cost of casting comes high.—W. J. R. Problem 2,933.

ELECTRIC RECTIFIER

Q.—Will you kindly let me know if there is an electrical rectifier, suitable for a small plating plant, for galvanizing, silver nickel and bronze plating.

A.—Several large electrical manufacturing concerns make small rectifiers suitable to be used on an alternating current to rectify or change the current to a direct current, and this can be used for small plating operations.

However, if you require more than a small quantity of current it would be better to buy a direct connected motor generator set, with motor suitable for alternating current and generator suitable for low voltage plating current.—C. G. B. Problem 2,934.

HIGH ZINC CASTINGS

Q.—We are having difficulty in getting perfect castings from a mixture of 85% zinc, 10% copper, 5% aluminum, and were wondering if you could let us know what our troubles would be. These castings appear perfect sometimes when taken from the sand, and on being machined we find them very porous.

A.—The mixture of 85% zinc, 10% copper, 5% aluminum is similar to Lumen bronze or Sampson metal, used for bearings; that is, it would require the same manipulation in casting. Lumen metal is an excellent die casting bearing metal and consists of zinc 86%, copper 10% and aluminum 4%. The Brinell hardness of this alloy chill cast is 115 to 125, specific gravity 6.9, tensile strength approximately 4,000 pounds, chill cast. The directions for working Lumen bronze are given as follows:

For sand casting, melt in a crucible and keep metal covered with blocks of wood, charcoal or sawdust; pour at dull red heat. This mixture holds heat longer than brass, and molds must not be shaken out too soon.

Make a large gate when no riser is in the mold. Make the gate where there is to be the largest body of metal. Have at least 4 in. cope, use larger sprue than for brass. Use sand as dry as can be consistently worked.

To make this metal 85% zinc, 10% copper, 5% aluminum, first make a hardener, 50 copper, 25 aluminum. Melt the copper and add the aluminum a little at a time. Stir well and pour into ingots. Use in proportions of zinc 85, hardener 15. Stir well when removed from the furnace and add a small amount of chloride of zinc as a flux.

I would also add, if cores are used in your work it is necessary to make a core that will give with the heat of the metal. Cores made similar to cores for aluminum will be satisfactory for this metal. I can not just tell what is the cause of your trouble. However, if you will follow the instruction as given you will find very little trouble with this alloy. Keep lead out of your metal, as lead and aluminum do not work together.

We will be interested as to the results you will obtain.—W. J. R. Problem 2,935.

INCREASING BARREL PLATING OUTPUT

Q.—We are mechanically nickel and copper plating small steel parts and must increase our output without increasing our equipment. It now takes thirty minutes to make a batch satisfactory. We are using a current of about 100 amperes running the barrel, which is 14 x 36, at 3 R. P. M., and our solutions are as follows:

COPPER SOLUTION.

Water	25 gals.
Sodium cyanide	25 lbs.
Copper cyanide	15 lbs.
Hyposulphite of soda	2½ ozs.
Soda ash	4 lbs.

NICKEL SOLUTION

Water	1 gal.
Double nickel salts	12 ozs.
Single nickel salts	4 ozs.
Common salt	4 ozs.
Boracic acid	2½ ozs.

Can we, by a change in current, speed or solution, speed up the time of plating?

A.—The copper and nickel solution, formulas of which you include in your letter, should be suitable for barrel plating. We would, however, recommend:

12 ozs. single nickel salts and
4 ozs. double nickel salts,

instead of your formula.

Your letter does not state the voltage of your plating current, which is important, because if you were running these barrels and only have 5 or 6 volts available, you could put on double the amount of metal and have a higher ampere density if you had a current of from 10 to 12 volts.

We presume that you are trying to plate your work with the lower voltage, and if so, you cannot plate as fast as you could at the higher voltage.—C. G. B. Problem 2,936.

PLUG COCKS

Q.—We are anxious to secure some information regarding the manufacture of ground plug cocks, and require information about the machining of plugs, reaming of bodies, the special compound used and the grease used in assembling.

We would be pleased if you could give us any data in the shape of books published on this class of work, and possibly some of your editorial staff could be of assistance to us.

A.—Reaming of the bodies and fitting the plaugs is the most important feature on ground key work. Bodies should be rough reamed, using an adjustable single inserted blade roughing reamer on a drill press or turret lathe.

By consulting the advertising section of METAL INDUSTRY, you can get in touch with manufacturers of cock grinding machines.

A lubricating grease composed of 35 per cent beef tallow, 35 per cent beeswax, 15 per cent lard oil, and 15 per cent cup grease thoroughly mixed and applied on the plugs in a liquid state with a small flat brush, will give good results.—P. W. B. Problem 2,937.

POLISHING COMPOUNDS

Q.—It is about two years that we are subscribers of your publication and we have the pleasure of stating that we have read it with always increasing interest.

We are long established dealers in Plating and Polishing Materials, with agencies and stocks in all principal cities of Spain and more than once we have come to profitable business with some of your advertisers.

Now, taking advantage of a Section of your Review we are taken the liberty of placing the two following problems that we should like to have solved.

1st.—Can you tell us of a good recipe to make a first class Polishing Composition?

2nd.—How can we prepare a white, brilliant Nickel Solution to be used in connection with a Plating Barrel?

A.—All manufacturers of polishing materials have their own particular formula and methods of manufacture.

For cutting down, Tripoli powder mixed with a molten mixture of stearic acid is used. Some tallow is added to prevent the mixture becoming too hard, preferably mutton tallow. Silica is frequently added to the Tripoli powder to cheapen the product.

For coloring articles that have been previously cut down with Tripoli composition or for the final finishing of nickel plated articles, Vienna lime or English gilders floated whiting is used, mixed with stearic acid to produce a solid composition.

Red oxide of iron of various finenesses is also used for polishing mediums.

Paraffine wax is used to some extent with stearic acid as a binder for the combinations of Tripoli, lime, whiting, oxide of iron, etc.

Some experimenting will be required to obtain the desired mixtures. No. 2. The following formula is used extensively in the United States for mechanical barrel plating with nickel.

Water	1	gallon
Single Nickel Salts	12	ozs.
Magnesium Sulphate (Voltage 6 to 8)	1½	ozs.
Boracic Acid	1½	ozs.
Sodium Chloride	¾	ozs.

After the solution is in operation for a few hours the addition of 10 fluid ounces of hydrofluoric acid per 100 gallons of nickel solution will produce a very white and bright nickel deposit.

Metallic cadmium is also used to produce bright nickel deposits. Several anodes of cadmium in the form of sticks 8 inches long, ½ inch in diameter should be properly secured to the anode rods or connections along side of the nickel anodes.

The cadmium anodes should be immersed in the nickel tank for a short time when the nickel deposit is dull and lustreless. As soon as the nickel becomes bright remove the cadmium anodes from the solution.

Repeat the operation when required. Gum Arabic is also used as a brightening agent. However, not more than 1 oz. previously dissolved in boiling water should be added per 100 gallons of nickel solution. Repeat at intervals of several hours, until a bright deposit of nickel results.—C. H. P. Problem 2,938.

POURING TEMPERATURES

Q.—We contemplate putting in a pyrometer for testing the pouring temperature of our alloys, and are writing to ask for information relative to the proper pouring temperature of formulas as follows:

Formula No. 1:
88 Copper, 10 Tin, 2 Zinc, 8 ounces 10% Ajax phosphor copper.

Formula No. 2:
90 Copper, 10 Tin, 8 ounces 10% Ajax phosphor copper.

Formula No. 3:
86 Copper, 6 Tin, 4 Lead, 4 Zinc.

Formula No. 4:
Composition yellow brass of approximate proportions, 60 Copper, 40 Zinc.

Formula No. 5:
80 Copper, 10 Tin, 10 Lead, 16 ounces 10% Ajax phosphor copper.
16 ounces 10% Ajax phosphor copper.

The above formulas are used in both heavy and light work. Would this also tend to make a difference in the pouring temperatures?

A.—The approximate pouring temperatures of the mixtures which you mention in your letter are as follows:

Formula No. 1—1950-1975 F.
2—1950-1975 F.
3—1925-1950 F.
4—1750-1775 F.
5—About 1875 F

It will be well to remember that in pouring light sections, the temperatures must be higher than for heavy work. Please bear in mind that these temperatures cannot be given exactly to the degree. They may vary 10 degrees in either direction and perhaps also with the particular job that you have at hand. However, we believe that they will give you a working basis from which to start.—A. B. Problem 2,939.

SILVER SOLDER

Q.—Where can I get information about silver solder?

A.—A work containing information on silver solders is "Mixed Metals," by Arthur H. Hiorns. On pages 388 to 400 can be found considerable data covering the various alloys for silver solders.

If it is required in granular form, then it should be poured slowly as soon as melted into cold water. The height from which the solder is dropped regulates the size of the grains.

The solder may also be run into wire by using a small square ladle, with handle attached. The ladle should be about 4 inches wide, 6 inches long and 1½ inches deep. Holes should be drilled in the ladle of the same diameter as the wire solder desired, about ½ inch apart at the bottom of the extreme front end.

The solder is put in the ladle, which is tilted so that the solder will not run out of the holes. A smooth iron plate should be used to pour the solder on.

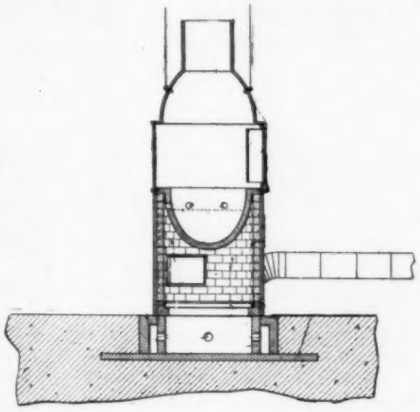
When all is ready tilt the ladle to such an angle that the solder runs out freely from the holes, and pass quickly over the iron plate. The result will be the solder in wire form, of a size depending upon the size of the holes used in the ladle.—C. H. P. Problem 2,940.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,362,429. December 14, 1920. **Soft Metal Furnace.** John B. McLain, of Brooklyn, N. Y.

This invention relates to furnaces and especially to furnaces for melting or reducting certain ores or metals that are not overly refractory.



Among the objects of the invention is to provide a furnace of novel design having peculiar merit for the reducing or melting of aluminum, Babbitt metal, solder, or other analagous soft metals.

Another object of the invention is to produce a furnace for melting metal in which the flames and other products of combustion are caused to pass through or over the bowl or other member which serves to hold the material being treated.

1,364,654. January 4, 1921. **Zinc Alloy.** Arrigo Tedesco, Turin, Italy, assignor to Societa Anonima Stabilimenti Biak, Turin, Italy.

This invention has for its object a zinc alloy having a fine grained structure and being adapted both to be machined by means of lathe, milling machine and generally by machine tools and to be worked by hot and cold forging and stamping, shearing, punching, holing and other metallurgical methods.

The proportions of the various constituents may vary according to particular characters required from the alloy, the amount of said metals being comprised within the ranges stated by following table:

Zinc	from	85	to	96	per cent
Cadmium	"	0.3	"	0.7	"
Nickel	"	0.5	"	8.0	"
Iron	"	0.5	"	1.9	"
Aluminum	"	2.5	"	7.1	"
Zirconium	"	1.2	"	2.5	"
Manganese	"	0.3	"	0.9	"
Copper	"	2.0	"	8.0	"

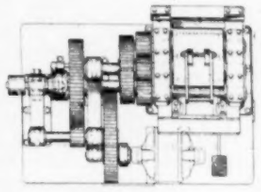
1,365,499. January 11, 1921. **Surface Alloyed Metal.** Floyd C. Kelley, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York.

The present invention relates to the surface treatment of metals, particularly iron, to produce an alloy with the foundation metal, and which has useful characteristics not possessed by the foundation metal, as, for example, superior corrosion resisting properties, luster, or color.

It has been discovered that when metallic chromium is brought into surface contact under suitable conditions with a foundation metal, such as iron, nickel, molybdenum, or tungsten, that the chromium enters the surface layer of the foundation metal below the melting point of either metal, and forms a layer of alloy decreasing in richness of chromium content from the surface to the interior of the foundation metal, and that the resulting alloy is resistant to corrosion and oxidation, is ductile, not excessively hard, has a bright shiny luster, and will take a high polish.

1,364,717. January 4, 1921. **Spelter-Breaker.** James Robert Coe, Waterbury, Conn., assignor to the American Brass Company, Waterbury, Conn.

This invention relates to an apparatus for breaking cakes of spelter and has for its object to produce a machine for accomplishing mechanically a result heretofore usually, if not always, attained by hand. It further has for its object to reduce the cost and labor of breaking bars of spelter and the like and also to provide a means for doing it more rapidly.



With the machine embodying this invention described herein, the cakes may be delivered directly from the door of a railroad car and broken up as fast as they can be unloaded from the car, the machine delivering the same to a storage bin or a container for transporting the broken cakes to storage bins or the casting shop.

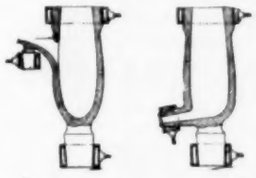
1,365,178. January 11, 1921. **Aluminum Alloy and Method of Making Same.** Alberto de Lavandeyra, Springfield, Mass.

This invention relates to aluminum alloys, and the method of making and treating the same. These alloys are particularly well suited for rolling, forging, extruding, swaging, etc.

The alloys which it is preferred to employ contain small amounts of manganese, magnesium, copper and chromium, with the balance of aluminum and its impurities. It has been found that the copper content should be from 2 to 5 per cent with a magnesium content of less than 1 per cent and a combined manganese and chromium content of 1 per cent or less. Whenever the chromium content is increased the manganese content is proportionately reduced.

1,366,135. January 18, 1921. **Electrically-Heated Crucible, Melting-Pot, and the Like.** Charles William Speirs, Battersea, London, England, assignor to Morgan Crucible Company, Ltd., London, England.

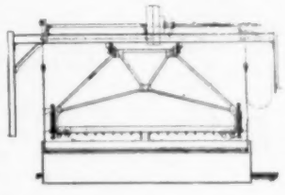
In crucibles, melting pots or the like of this type the connections for the terminals of the electric current supply are placed at opposite ends of the vessel so that the current traverses the body of the latter, but it is found in practice that the spout, lip or pourer remains comparatively cool, thus tending to cool the metal which has been melted in the crucible or pot as it is being poured therefrom.



Now, this invention has for its object to obviate this disadvantage, and to this end provision is made for electrically heating the spout, lip or pourer.

1,366,152. January 18, 1921. **Dipping and Quenching Arrangement for Metal Bars or Other Metal Articles.** Johannes Robert Carl August, Halifax, England.

This invention relates to improvements in apparatus for annealing, tempering or otherwise modifying the physical characters of metal bars or other metal articles.



The invention is more especially concerned with dipping and quenching arrangements, and is especially useful for dealing with long metal bars in connection with which it will be hereinafter more particularly described by way of example.

One of the objects of the contrivance is to enable long thin bars to be handled separately instead of in bundles, thereby giving uniform results in the heat treatment and keeping the bars as straight as possible.

1,366,167. January 18, 1921. **Compound for the Automatic Removal of Copper from Ordnance.** Alain Elie Alfred Dagory, of Bois Colombes, France.

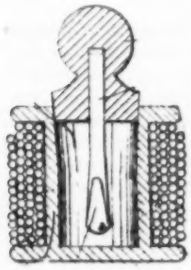
This invention relates to a compound for automatically freeing guns of all calibers from the copper which is deposited, during the firing, in the interior of the bore.

The operation which consists in removing this copper, and is ordinarily called "decoppering," takes place rapidly and automatically by utilizing the compound which constitutes the subject matter of the present specification.

The invention is based on the affinity which tin when in a state of fusion has for copper and on the property which these two metals possess of forming together compounds of relatively low melting point and in all cases lower than the temperature attained by the powder gases during the passage of the projectile through the bore of the gun.

The compound is composed of tin and lead and is placed in the bore of the gun during the firing.

1,366,278. January 18, 1921. **Soldering-Wire Spool and Flux-Container.** Adolph C. Recker,, Oakville, Conn., assignor to the Chase Companies, Inc., Waterbury, Conn.



This invention relates to an improved soldering-wire spool and flux-container, designed to be used for the convenience of all persons who have occasion to do soldering operations, particularly in a small way; the object being to produce for the purpose described, at a very low cost, a simple, compact and convenient carrier for the wire and flux.

With these ends in view, this invention consists in a combined soldering-wire spool and flux-container having certain details of construction as will be hereinafter described and pointed out in the claim.

1,366,534. January 25, 1921. **Anode.** Joseph Albert Hall. New Britain, Conn., assignor of one-half to Leonard E. Henry, New Britain, Conn.

This invention relates to improvements in anodes, of the form used for electro-plating with nickel, copper, and other metals, and the object of my improvement is to produce an anode having a form of construction that is substantially without sharp points or edges, that presents a relatively large surface that is exposed in the bath as a working or active surface, and that will be reduced or eaten away by the corrosive effect when in use substantially uniformly for different parts of the length and thereby avoid waste.

1,366,875. January 25, 1921. **Casting-Machine.** Armand Collignon, Paris, France, assignor to the firm Contenau & Collignon, Paris, France.

This invention relates to a machine for molding metals, intended more particularly for dental apparatus, and its object is to execute, by mechanical device, work which has hitherto been done with a hand bandage.

A bandage requires great professional skill, which is no longer necessary with this new machine, which can be operated by any one.

Said machine consists essentially of a frame provided with a drum which takes up a spiral spring wound up by means of a crank. Upon being released, the spring causes the rotation of a nave provided with an arm carrying an oscillating cage which accommodates the mold and rotates in a vertical plane.

1,366,977. February 1, 1921. **Metal Polish.** Henry Trueberg, Astoria, N. Y.

This invention relates to improvements in compositions of matter particularly adapted for polishing metals or similar surfaces.

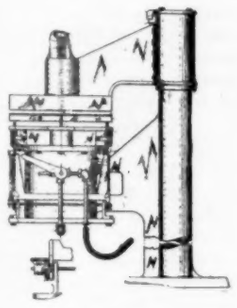
It has for its object the provision of a polish which is free from deleterious and dangerous ingredients often used, which is of a very fine grain, and which utilizes material now commercially treated as waste.

It is preferred, however, to use substantially the following proportion of ingredients:

Finely divided carbon material.....	one part
Whiting	one part
Water	four parts

1,366,692. January 25, 1921. **Molding Machine.** James E. Jones, Richmond, Indiana.

The object of the present invention, broadly speaking, is to provide a matrix forming machine which will be strong and durable in construction, simple in character, positive in action, easily operated and controlled, and which can be manufactured, sold, and operated at a comparatively low price.



In molding metal it is customary to form the mold or matrix of sand, taking the impression in the sand from a pattern provided for that purpose. Withdrawing the matrix after it has been formed by the pattern is one of the most delicate operations to be performed in the operation of machines of this character. To accomplish these results and provide means for applying the proper degree of pressure to pack and bind the sand to form the matrix and give it the proper degree of cohesion is the paramount object of this invention.

1,367,768. February 8, 1921. **Process for the Treatment of Copper Sweeps and Scraps.** Clement Camillo Cito, Brussels, Belgium.

The invention relates to the treatment of copper sweepings and scraps containing besides copper, zinc, iron, silica or other impurities.

These sweepings and scraps, which are generally the residues of the dressing of sweepings of foundries and copper smelting works, vary in composition according to their origin, the lower and upper limits being, on the average, as follows:

Copper	5—10	per cent
Zinc	3— 8	"
Iron	2— 6	"
Tin and antimony.....	1— 2	"
Silica	75—60	"
Organic matter	10— 5	"

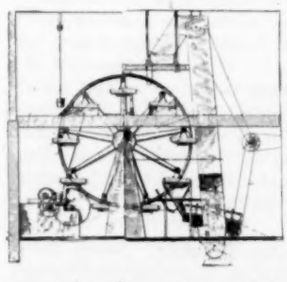
The new process may include both a dry treatment and a wet treatment.

The first operation consists in a chloridizing roasting process, having two objects:

1. To destroy and expel the oily organic matters.
2. To transform the entire copper contents present in a state of metal into a copper salt from which the copper is easily recovered.

1,367,059. February 1, 1921. **Casting Machine.** Archer A. Landon, Buffalo, N. Y., assignor to American Radiator Company, Chicago, Ill.

This invention relates to improvements in casting machines, and the same has for its object more particularly to provide a machine by means of which casting operations may be performed in a substantially continuous manner.



Further said invention has for its object to provide a machine comprising a revoluble carrier supported in vertical position and provided with means for receiving a series of molds at one point, and for removing the same therefrom at a point adjacent to, but below the point where the same are received by said carrier.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

Alloying Precious Metals Electrically

Making a Platinum Alloy in Ajax-Northrup High Frequency Induction Furnace*

Written for The Metal Industry by DUDLEY WILLCOX

The melt described below is particularly interesting because made by an absolutely new method. The advantages over previously existing methods are that there is no contamination by carbon or other impurities, and that the metal is stirred electromagnetically so as to produce a very homogeneous alloy.

No arc or resistance material is present in the furnace. The metal to be melted is heated by eddy currents induced in it by high frequency current in a coil surrounding the furnace lining. The coil is made of flattened copper tubing which carries a stream of cooling water. The temperature of the coil never exceeds 100 deg. C., and usually runs about 60 deg. C. No part of the furnace is as hot as the metal being melted.

The particular furnace used in this test is known as the 6" "Electric Crucible" made by the Ajax Electrothermic Corporation. It is shown in approximate cross-section in the accompanying figure.

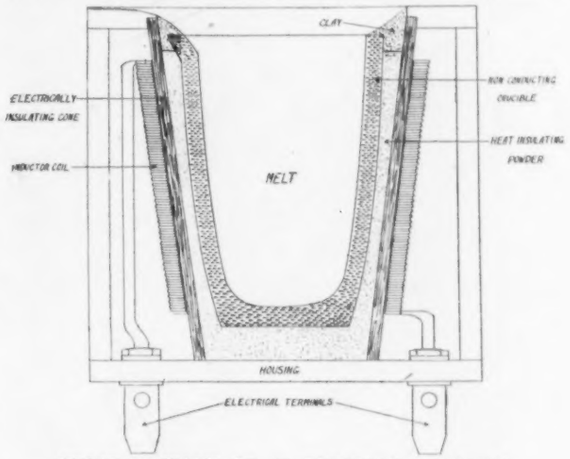
A standard No. 5 clay crucible was placed in the furnace as shown, and was washed on the inside with electrically sintered magnesia.

The alloy to be made was of approximately the following composition:

Fine Gold 85%
Commercially Pure Platinum.....15%

The weight of metal to be melted was 50 troy ounces. The gold was in the form of sheets about 1/16" thick and 1½" square. The platinum was cut in strips approximately 1/64" x 3/16" x 1½". Two of the sheets of gold were laid horizontally in the bottom of the crucible, and on the topmost was placed a layer of the platinum strips approximately 1/16" thick. One or two more squares of gold were laid on the platinum and the layers were built up until the crucible was three-quarters full, and there were about eight alternate layers of gold and platinum. The crucible was warmed up to a red heat by external means before the metal was charged in order to dry the wash of magnesia which had been applied only an hour before the melt was made. The electrical conductivity of the crucible was such that it did not heat at all by induction.

When the high frequency current was applied to the inductor coil the platinum strips near the top of the charge could be seen to redden almost instantly. They continued to heat until the gold started to go down. The platinum and gold fused together as the melt progressed, some of the platinum apparently alloying with the gold at a temperature far below the platinum melting point. In two and one-half minutes the entire mass was liquefied with



CROSS SECTION OF 6" ELECTRIC CRUCIBLE.

the exception of two or three of the small platinum strips which seemed especially refractory. In about six minutes the pieces were all melted and the alloy was considered ready to pour.

The metal was poured into an open iron mold laid broad side down and formed an ingot about ½" thick by 2" wide by 3" to 4" long. This piece subsequently was rolled out and was found to be free from platinum streaks which have given much trouble when melts of the same alloy have been made in gas fired furnaces.

Centrifugal Clarification for Contents of Dipping or Spraying Tanks

Continuous clarification of the material in dipping tanks or in the reservoirs of spraying machines is one of the newer applications of the De Laval Multiple Clarifier. This machine has been used for several years by manufacturers of japans, lacquers, varnishes and pigment goods to free their products of the various impurities which might cause trouble to the user. It is also extensively used in machine shops to remove impurities from used cutting oil so that it can be kept in service indefinitely.

The newer use of the multiple clarifier is said to solve one of the most serious problems encountered in the use of dipping tanks or spraying machines; that is, to remove continuously from the tank the impurities which are carried into it by the air or with the material being dipped. When this can be accomplished, a product having a smoother finish is obtained and rubbing is reduced to the minimum. A typical example of the saving which can be effected when this is done is found in the experience of a well-known automobile manufacturer. Before centrifugal clarifiers were installed in this plant about 60 per cent of the finished product was being returned from the inspection department for further rubbing. The amount of returns was reduced to 3 per cent after the clarifiers were installed and in operation. There is an additional saving where this system is used, due to the fact that none of the material in the tank is lost.

By referring to the accompanying cross-section of multiple clarifier bowl, some idea of how the machine does its work can be obtained. This bowl revolves at a speed of from 6,000 to 8,000 revolutions a minute, which is sufficient to furnish the centrifugal force necessary to accomplish clarification and yet low enough so that the machine will not be subjected to unnecessary wear. The material to be clarified is fed into the top of the bowl and first enters the inner chamber, where the heavier and more easily separated solids are thrown out and held in the sediment pockets. The semi-clarified product then passes into the second or outer chamber, where by reason of the greater diameter a maximum centrifugal force clarifies it of the finer impurities which are more difficult to remove. The clarified product is then forced upward and discharged from the lower spout of the machine.

The bowl is constructed so as to give it large dirt-holding space and this permits the machine to be operated on long runs without shutting it down for cleaning. This is claimed as another advantage of centrifugal clarification over the methods previously employed, as it is stated that the time required for cleaning it amounts to but about one-sixth of that consumed by other methods.

The accompanying installation diagram shows the general arrangement of multiple clarifiers with the dipping tanks, when it is possible to place the machines above the tanks. When this is not convenient, the clarifiers may be placed on the floor below, if desired, and the liquid allowed to flow by gravity from the bottom of the tanks into the clarifier, from which it is pumped back into the tanks. The machines occupy only about four square feet of floor space and are made in capacities ranging from 5 to 300 gallons of clarified liquid per hour; the capacity of any

*This furnace was described in full, in THE METAL INDUSTRY, May, 1920, page 213.

certain size of machine depending on the character, viscosity and condition of the product. Multiple clarifiers are furnished for either belt, electric motor or direct connected steam turbine drive, and the larger size machine operates on less than 2 horsepower.

A machine somewhat similar to the multiple clarifier, but which is designed to handle liquids of higher viscosity and to remove

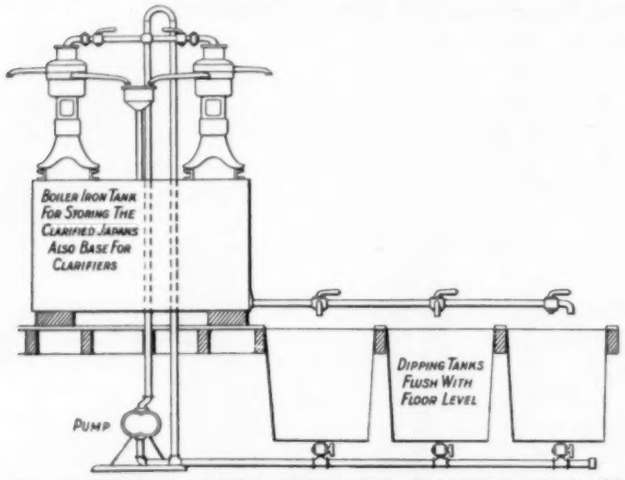


FIG. 1. SHOWING HOW CENTRIFUGAL CLARIFIERS MAY BE ARRANGED TO KEEP THE CONTENTS OF DIPPING TANKS CLEAN.

even smaller particles of foreign matter than those which must ordinarily be eliminated is termed the Centrifugal Filter. The bowl of this machine operates on the same principle as that of the multiple clarifier, except that after the heavier impurities have been removed by centrifugal force, the semi-clarified material is forced upward through a series of discs having layers of filter paper between them. This filter paper seldom requires changing for cleaning, because the centrifugal force generated in the bowl cleans the surface of the papers and throws impurities out to the dirt-holding space. The outward construction of this machine is identical with that of the multiple clarifier. The power requirements are also the same, but the hourly capacity of the machine is somewhat lower.

These machines and their application to various lines of industry are fully described in Bulletin No. 200, copies of which can be obtained by writing to The De Laval Separator Company, 165 Broadway, New York, N. Y.

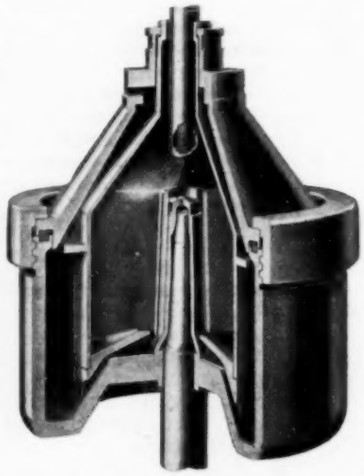


FIG. 2. CROSS SECTION OF MULTIPLE CLARIFIER BOWL.

NEW HARDNESS TESTING MACHINE

The microcharacter, a machine for testing the hardness of metals and alloys, has been developed by the Special Committee on Bearing Metals of the American Society of Mechanical Engineers, with C. H. Bierbaum of Buffalo as chairman. The machine consists essentially of an attachment to a microscope for making fine scratches across a polished section. The width of this scratch is measured and the hardness calculated by means of the following formula:

$$K = L^{-3}\ 10^{4}$$

where K = microhardness

L = width of the scratch in microns (thousandths of a millimeter).

A scale showing the relative microhardnesses, varying with the widths of the scratches, is:

Width of Scratch	Microhardness
50 Microns	4.00
40 "	6.25
30 "	11.1
20 "	25.
10 "	100.
9 "	123.
8 "	156.
7 "	204.
6 "	277.
5 "	400.
4 "	625.
3 "	1,111.
2 "	2,500.
1 "	10,000.
.9 "	12,345.
.8 "	15,625.
.7 "	20,409.
.6 "	27,777.
.5 "	40,000.
.4 "	62,500.
.3 "	111,111.
.2 "	250,000.

Full information can be obtained from the Spencer Lens Company, Buffalo, N. Y., who did the experimental work for the committee.

NEW REPEATED IMPACT TESTING MACHINE

In the design of a machine for testing by repeated impact several considerations must be taken into account if the results of tests are to be interpreted accurately. It is essential that the true energy of the blows should be calculable if various results are to be truly comparable. In some designs hitherto used these conditions have not been strictly fulfilled, the hammer had attachments and some doubt always existed as to how much of the mass of the attachments was actually effective in the blow. Lack of rigidity was another embarrassment because the result depended largely on the nature of the base upon which the machine was mounted.

In the design of the Eden-Foster Repeated Impact Machine it is claimed that these requirements have been fully met. The hammer is without attachments and falls freely under the influence of gravity, the whole falling mass of the hammer is symmetrically disposed above the point of impact and the actual height of the fall may be measured easily so that the true energy of the blow is calculable to a high degree of accuracy. The machine is sold by Holz & Company, Inc., 17 Madison avenue, New York.

BIAS BUFF

The Bias Buff which was described in THE METAL INDUSTRY February, 1921 (p. 90), is made with cloth buffs instead of metal (as shown in the cut, which was made of an earlier model). The following advantages are claimed:

1. It will do three to four times as much work as the standard loose leaf buff.
2. Because the number of working threads remain the same as the buff is worn away, it retains its working efficiency until completely used up.
3. It reduces lint and dirt to a minimum, because of the fact that it does not unravel.
4. It wears evenly and is less fatiguing to the operator.
5. Burning of the buff is practically eliminated, owing to the air pockets caused by the gathering puckers.
6. It does from 45 to 57 per cent more work in the same length of time and accordingly reduces the labor cost to this extent.
7. It requires considerably less tripoli to turn out the same amount of work.

Figuring only the cost of the buffs themselves, without considering its other advantages such as the saving in labor cost by doing more work in the same time, etc., the Bias Buff will cost only one-half what the loose leaf buff costs for the same amount of work.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

BRASS MANUFACTURERS

The National Association of Brass Manufacturers held its Spring meeting at the Hotel Sherman on Tuesday, Wednesday and Thursday, March 22nd, 23rd and 24th, which was well attended and much good was accomplished.

It authorized the appointment of a new catalog and list committee but decided not to issue a new catalog until 1925, being the regular five-year period the association had agreed with the various allied and jobbers' associations in which changes in lists and issuing of catalogs would take place. Ordinarily a new catalog would have been issued in 1920, but owing to war conditions, it was decided to put it over until 1922, since when conditions have arisen that made it advisable to delay the getting out of a new official catalog until the regular period—1925, when like changes will, no doubt, be made by manufacturers in kindred lines.

The legislative committee was urged to hold themselves in readiness to proceed to Washington during the special session of Congress, to do their part in the matter of adjustment of the excess profits tax, and by resolution, authorized not only the standing legislative committee, but all members to do their part in the matter of repealing the Adamson Law.

President Fischer was elected to represent the association at the next meeting of the National Pipe and Fittings Association, to be held in Cleveland.

Request for the adoption of the metric system was referred to the standardization committee.

A number of guests, non-members, attended the meeting and expressed themselves as gratified with the proceedings and the manner in which the association conducted its affairs.

Meeting was polled as to the present outlook and business conditions, and while some plants reported operating full force and time, the great majority reported working short hours and short forces with a fair average of about 75 per cent of normal and the universal opinion was shared in that the attitude of labor is the key to the situation and that if the working men would take a fair and rational view and a reasonable reduction in wages, it would go a very long way, if not to a great extent, solve the present tie-up in the building industry.

The commissioner's report showed that the association was in splendid shape financially and an order passed to purchase bonds with the available surplus.

After a busy day's session, the meeting adjourned to meet next in Buffalo, N. Y., at a date yet to be selected the fore part of June.

SOCIETY FOR TESTING MATERIALS

The American Society for Testing Materials has submitted the following copper specifications to the American Engineering Standards Committee for approval:

Specifications for Soft or Annealed Copper Wire (B3-15).

Specifications for Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars (B4-13).

Specifications for Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars (B5-13).

Methods for Battery Assay of Copper (B34-20).

The specifications are submitted in accordance with the special provision in the procedure of the Committee, under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The Committee would be very glad to learn from those interested, of the extent to which they make use of these specifications, and to receive any other information regarding the specifications in meeting the needs of the industry.

Specifications B3-15, B4-13 and B5-12 may be found in the 1918 volume, and Specifications B34-20, in the 1920 volume of A. S. T. M. Standards. Copies of these may also be obtained from the American Engineering Standards Committee, 29 West 39th street, New York. Price 25 cents each.

WASTE MATERIAL DEALERS

At the meeting of the metal division of the National Association of Waste Material Dealers held in the Hotel Astor, New York, on Monday, March 14, H. L. Green was elected Chairman. Mr. Green is manager of the New York office of the Great Western Smelting and Refining Company, and in charge of all their Eastern and European business. He is also a director in the British and French subsidiary companies of the Great Western Smelting and Refining Company, and is, therefore, on account of his wide knowledge of the field, admirably fitted for the post for which he has just been chosen.

It is his intention to take active personal charge of the Metal Division and to build it up as much as possible. The difficulties at present are that the Division, although great in number, still has not as many members as it deserves, probably because the members do not take sufficient active interest. Certainly, nothing is more necessary for the trade than a strong, active and energetic organization to look after its interests and to further and aid co-operation between the members. Although a great deal has already been accomplished, there still remains much work ahead. During the war, the Government recognized the Association on many occasions, and a number of its members were placed on the various War Boards in influential positions.

H. L. GREEN

For future meetings it is Mr. Green's intention to gather the members by means of a personal letter to each. These meetings will be open to the Press and to those of the public who are interested.

At the March 14 meeting, after the election, the new chairman was authorized to appoint a committee to formulate the stand of the association on the proposed duty on tin. This committee has the power to act, and will, in co-operation with others, lay before the proper officials in Washington, information showing that a duty on tin would be detrimental to the interests of the trade.

AMERICAN ELECTROCHEMICAL SOCIETY

The coming meeting will be held in Atlantic City, April 21 to 23, 1921. Among the papers read will be the following:

D. M. Buck: Some Observations on the Mechanism of the Increased Corrosion Resistance of Steel and Iron Due to Small Copper Contents.

O. P. Watts and H. C. Knapp: The Effect of Copper and Silver Salts on the Corrosion of Iron by Acids.

O. P. Watts: Principles of Alloying to Resist Corrosion.

H. S. Rawdon: Some Types of Non-Ferrous Corrosion.

E. R. Shepard: Electrolytic Corrosion of Lead by Continuous and Periodic Currents.

O. H. Eschholz: Phenomena of Arc Welding.

H. W. Gillett: Electric Furnaces for Non-Ferrous Metals.

Carl Hering: Electrodynamic Forces in Electric Furnaces.

E. F. Northrup: Recent Progress in High Frequency Induction Heating.

William Blum: Use of Fluorides in Solutions for Nickel Deposition.

C. P. Madsen: Ductile Electrolytic Nickel.

BRITISH METALS RESEARCH ASSOCIATION

The activities of the British Non-Ferrous Metals Research Association, which was incorporated in January, 1920, have been devoted mainly during the past year to bringing the aims and

objects of the Association before manufacturers and in taking over researches initiated by the Scientific and Industrial Research Department, pending the formation of the Association.

The Council record with regret that the support so far given to the Association is not commensurate with the importance of the work that it is undertaking in the future interests of the industry. This is no doubt partly accounted for by the unsettled state of industry at the present time, but it is also evident that the industry as a whole is not yet convinced of the importance and necessity for further research on non-ferrous metals and alloys. The scope of the investigations that can be undertaken by a Research Association is necessarily limited by finance, consequently the lack of support has retarded progress.

The researches taken over by the Association include (1) An investigation into the production of sound brass and copper castings. (2) The atmospheric corrosion of non-ferrous metals, and (3) The effect of foreign elements on copper.

The first of these researches was completed at the end of 1920, and a report has been issued to members. The laboratory experiments were repeated on a works scale and good results obtained.

The other two researches are being proceeded with, and technical committees have been appointed to deal with further research in other branches of non-ferrous metallurgy.

The Association is organizing its Bureau of Information on the most comprehensive lines possible, and is issuing periodically a Bulletin of references to current literature relative to the manufacture and working of non-ferrous metals and alloys for the benefit of its members.

With the return to more normal conditions it is hoped that manufacturers in this important national industry will give their whole-hearted support to the Association that has been especially established in their interests.

For information, write to Ernest A. Smith, Secretary, Athenaeum Chambers, 71 Temple Row, Birmingham, England.

BRITISH INSTITUTE OF METALS

The Annual General Meeting of the Institute of Metals was held at the Institution of Mechanical Engineers, Storey's Gate, London, on Wednesday, March 9. Engineer Vice-Admiral Sir George Goodwin, K.C.B., President, was in the chair.

The president, in putting the annual report to the meeting, said the report was a very full one and there was very little he could say which would throw any additional light on the work of the Council during the year. The figures for the membership were very satisfactory, and were constantly increasing, but the rate of increase was not altogether satisfactory. Nevertheless, during the 12 years the Institute had been in existence, it had built up a membership which compared very favorably with the progress made in other institutions. Since the report had been issued, the membership had increased to the record of 1,342.

One new committee had been formed during the year, viz., a sub-committee of the Corrosion Committee, to deal with the special problem of aluminum corrosion.

The new officers elected are: President, Engineer-Vice-Admiral Sir George Goodwin, K.C.B., LL.D. Past-Presidents, Sir Gerard A. Muntz, Bart.; Professor W. Gowland, F.R.S., A.R.S.M.; Engineer Vice-Admiral Sir Henry J. Oram, K.C.B., F.R.S.; Sir George Beilby, Kt., F.R.S., LL.D.; Professor H. C. H. Carpenter, M.A., Ph.D., A.R.S.M., F.R.S.; Vice-Presidents, G. A. Boeddicker, Birmingham; J. T. Milton, London; Sir Thomas Rose, Kt., D.Sc., A.R.S.M., London; W. Rosenhain, D.Sc., F.R.S., Teddington; L. Sumner, O.B.E., M.Sc., Manchester; Professor T. Turner, M.Sc., A.R.S.M., Birmingham. Honorary Treasurer, A. E. Seaton, London.

CLEVELAND BRANCH, A. E. S.

At the last meeting of the Cleveland Branch, March 26th, the attendance was rather slim owing, no doubt, to its being too near to Easter Sunday and the boys were out looking for rabbits, etc.

As it was our regular monthly business meeting there were no papers read or discussions thereon, for those matters claim our attention principally on laboratory nights. The second Saturday of each month is devoted to papers, analytical work, discussions and a general get together. It is called our laboratory night. The last Saturday of each month is confined usually to business and minor discussions.

At this writing we have on hand some very interesting papers that will be read and criticized at our next meeting on April 9th.

Mr. Pleadwell presents an able article on Cyanide Zinc plating, displaying some very fine samples. Mr. Ramerman is due with an article on Electro Strip for Nickel; Mr. Purcell on Nickel Anode Analysis.

There will also be demonstrations of polychrome lacquer spray finishes. Our laboratory is well supplied with lacquers and metallic powders for all fancy spray and brush finishes and we are also equipped with facilities for making chemical analysis of plating solutions, anodes, etc. We also have apparatus for determining the amount of metal in solutions by the electrolytic method. Our librarian, Mr. Singler, is keeping the boys busy preparing articles to read at future meetings.

INDIANAPOLIS BRANCH, A. E. S.

The branch held its regular meeting March 12th with President Hennessey presiding. The attendance was fair. One member was reinstated as active member. It was moved and carried that we tender a vote of thanks to THE METAL INDUSTRY for their gift of the 1920 bound volume of THE METAL INDUSTRY.

A reception committee for the convention was appointed with H. C. Warner, 20 Gladstone Apartments, East Washington St., Indianapolis, Ind., as chairman. The report of the various committees on convention work show they are on the job and progressing nicely.

MILWAUKEE BRANCH BANQUET

The Milwaukee branch's second banquet, March 19th, 1921, at the Maryland Hotel, was a very successful affair, both as to attendance and the character of the papers and addresses. Everybody was well pleased and announced it as a great success. While there were a number of changes in the program, credit for carrying it out "without a hitch or dull minute" must be given to Jos. Birnbaum, called on to act as toastmaster in place of Fred. G. Hunt. We had many out-of-town visitors. The Chicago delegation came on the "Dry Special." We were very sorry that the Chicago boys did not stay till the program was finished, but they had to leave at 11 o'clock in order to make connections.

The program was as follows: Selection, Cream City Quartette; address, Toastmaster Jos. Birnbaum; address, Our Society, L. H. E. Armour, President Milwaukee Branch, A. E. S.; selection, Cream City Quartette; address, Benefits of the A. E. S., H. E. Willmore, Chicago; Paper, "Chemical Control, Its Application and Value," Roy Willys Armour, Milwaukee; selection, Cream City Quartette; address, Taylor Frye, Industrial Commission, Madison, Wis.; selection, Cream City Quartette; paper, "Nickel Solutions," R. J. Hazucka, Chicago; selection, Cream City Quartette; address, Pat. Sheehan.

The committee on arrangements was composed of L. H. E. Armour, chairman; D. Wittig, F. J. Marx, J. E. Hornwall, R. Stearnagel, John Andryske and A. F. Brown. On the reception committee were J. W. Miszenski, A. E. Koehler, E. C. Yeager and P. J. Sheehan.

NEWARK BRANCH, A. E. S.

The third annual banquet was held at Achtel-Stetter's Banquet Hall, 842 Broad St., Newark, N. J., Saturday, April 9, 1921, at 7:30 P. M. After the banquet the first address was given by Philip Sievering, of New York, after which Dr. Thompson took his post as toastmaster. An excellent program was held until 10:30 P. M., when the floor was cleared for games and dancing. The large number of ladies present added to the gaiety of the evening. Souvenirs were given out by the J. B. Ford Company, the Egyptian Lacquer Company and the Eureka Pneumatic Spray Company. The attendance totaled 176.

NEW YORK BRANCH, A. E. S.

President Sterling presided at the February meetings of New York Branch. Two applications for active membership were received and referred to the board of trustees. The educational

value of Dr. Blum's, Prof. Madson's and Mr. G. B. Hogaboom's discussions concerning the Electro deposition of metals at the banquet's afternoon session were highly complimented.

The following plating problems were discussed at length:

The Production of the Swiss Gun Metal Finish, Metal Cleaning and the composition of a Black Dip Solution for Red Brass and Bronze.

Discussions on the following papers were held:

A Minimum Current Density in Commercial Silver Plating, by Frank Mason. Factors of Importance in Silver Plating, by E. C. Nesle.

ROCHESTER BRANCH BANQUET

To say the eighth annual banquet of Rochester Branch was a grand success is very tame. They made a speed record from a flying start to a whirlwind finish. First on the "Docket," register, separate yourself from the necessary "Green Goods," get your badge, then pin a beautiful carnation on your outermost garment. Yep—We had carnations, thanks to the generosity of the Ladies' Auxiliary of Rochester Branch. Listen! Sure, Mike, that was real jazz music. Let's go inside and wrap ourselves around the menu.

William Schneider was song leader and kept the ball a rolling. Gartland will be our next song leader as he has all the real shimmie movements and he sure shakes a wicked shoulder. Mr. Hesselink introduced Mr. Lopez as toastmaster. Mr. Flannigan was then called on and he gave us a line on New York's banquet, as did Mr. Haddow. Mr. Gartland, our president, was the next speaker. In his remarks he praised the Ladies' Auxiliary to the skies and patted the banquet committee, made up of George Hesselink, E. E. Fitch and Bert Groh, on the back. Mr. Gartland asked that Mrs. Fitch, Jr., and Mrs. Hesselink, president and treasurer, respectively, of the Ladies' Auxiliary of Rochester Branch, make a speech. Mrs. Fitch, Jr., was the first to speak. Her remarks were very limited, as were Mrs. Hesselink's, who next had the floor, and had to do only with their organization.

Our entertainment program was next in order. A violin solo by Mr. Groh, who is a coming Kreisler; a vocal solo by Miss L. Weber was very well received. A Dream—dreamed and read by Mrs. Geo. Hesselink—was a big hit. In her dream Mrs. Hesselink had all the ladies of the auxiliary dressed in costumes of Oriental colors, doing everything from "The Turtle Walk" to the "Shimmie" on the stages of various midway shows. It was well gotten together and drew many a broad smile. A vocal solo by Mr. William Schneider was very well done—Mr. Schneider has a very fine voice and his work delighted everyone. Character recitations by Mrs. R. F. Dowdell seem to come natural to Mrs. Dowdell. Her expressions could not be improved upon.

A piano solo as was given by Mrs. Gibbs was something worth going a long ways to hear. A poem dreamed, written and read by Mrs. E. E. Fitch, Jr., turned the clock ahead to 1948, and placed the members of Rochester Branch in every position but "Tank Jazzing." Mrs. Fitch's poem does everything from placing Mr. Gartland as a clown in a circus to putting Mr. Fitch, Jr., on the "water wagon." Even Harry Bernard liked it. A vocal solo by Mrs. Clayton Lampham was something long to be remembered. Mrs. Lampham has perfect control of a voice whose beauty and expression are hard to find words to express.

We next went into the dance hall where Miss Vivian Groh, a tot of about 7 years, gave us a very pleasing exhibition of Chinese dancing. Miss Vivian is a born dancer.

As the orchestra struck up "Margie Let's Go," all the jazzhounds got on the floor. They're off! Running hard, neck and neck on the half, Desmond, Brownell and Knight dancing great; Schneider, Durkin and Jordan second.

One-step, free for all. Entries—Reama, Gartland, Froxler, Lopez, Hesselink, Wilcox, Jordon and Desmond. Won by Reama, Jordan being a good second and going fast at the tape.

Virginia Reel—Gartland vs. Troxler. Style—Catch-as-catch-can. Time—15 minutes, one fall to count. Both men were on their feet at the finish. Troxler seemed to be suffering from perspiration. Gartland was in perfect condition and as cool as the equator at the finish.

Gartland was as busy as a one-legged clog dancer in the Virginia Reel calling off, instructing and dancing.

The program of ten dances ended with a Dreamy Waltz, honors going to Lopez and Hesselink. If they ever come together again I'll bet on both of them. The clock in the steeple struck the hour and the eighth annual banquet of Rochester Branch, A. E. S. was history.

E. E. Fitch, Jr.

METAL TRADES ASSOCIATION

Education as a cure for Socialism was offered by Dr. Charles Aubrey Eaton, editor of Leslie's Weekly, in an address March 31 at the annual banquet of the Indianapolis branch of the National Metal Trades Association. The banquet which was attended by more than 600 members of the organization and their guests, was held in the Riley room of the Claypool hotel.

"I do not pretend to offer a cure-all for the present industrial situation," said Dr. Eaton, "but I do believe that if the employers will only band together and try to educate labor in the difficulties of their business, the problem of Socialism will be cured. Labor will always follow a leader. Instead of permitting the leader with the false solutions of Socialism to arise from their own ranks, let the employer, by gaining the confidence of his men, show his right to be the real leader. Beat the professional deliverer to it; be your own deliverer.

"I believe in the labor union as a constructive organization, but I do not believe in the destructive policy of strikes and the effort being made to force closed shops. If the employer will only cultivate the 'get-together' attitude, the laborer will realize the difficulties of business and there will be no urge to turn to Socialism."

Stanley Whitworth was unanimously elected president of the Association at a business meeting preceding Dr. Eaton's address. Other officers were elected as follows: George O. Rockwood, vice-president; L. M. Wainwright, treasurer; H. G. Myers, Harvey G. Shafer and Alfred Kauffmann, members of the executive committee for two years, and William H. Oakes, member of the executive committee for one year.

The following men were elected members of the Eleventh district committee for one year: R. P. Johnson, Muncie; A. G. Seiberling, Kokomo; D. E. Ross, Lafayette; Frank B. Ansted, Connersville, and Robert H. Hassler, Indianapolis.

ASSOCIATION OF PURCHASING AGENTS

For some time past the Fuel Committee of the National Association of Purchasing Agents has been engaged in formulating recommendations for reasonably uniform provisions in coal contracts. The purpose of the committee has been to express its idea of a fair contract to be used for the purchase and sale of coal. To avoid overlooking important details and to prevent any bias in its suggestions, the committee conferred with a number of leading producers and wholesalers in the coal field, holding a meeting for this purpose at the Hotel Pennsylvania, New York, on March 15.

The conclusions of the committee are expressed in the form of a contract. It is believed that the form can be advantageously used for most commercial contracts for the purchase of coal, and where special conditions require special clauses, these might be added to the contract. Copies of this contract can be obtained from Harry Botsford, assistant to the president, National Association Purchasing Agents, 19 Park Place, New York.

VARNISH MANUFACTURERS

The Plant Managers of the New York and Northern New Jersey sections of the National Varnish Manufacturers' Association, held their 16th meeting on Thursday, February 24, in New York, Mr. Frank Schumann, of Hilo Varnish Corporation, presiding.

After a discussion of suggested changes in Spar Varnish Specifications as recommended by the Inter-Departmental Committee, it was recommended that this subject be taken up again at the next meeting after the various members had had an opportunity to deliberate on the suggestions.

An interesting discussion on the Causes, Prevention and Cure of "pitting" or "pock marking" in Black Baking Japan, brought out many helpful points.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

William C. Cochrane will represent the Detroit Brass and Malleable Works, Detroit, Mich., in the Eastern territory, in the interests of both its brass and fitting lines.

F. F. Pierdon, former superintendent of the Anodian Metal Company, Baltimore, Md., succeeds Mr. Gilchrist as superintendent of the Morgan General Ordnance Depot.

E. Schor has accepted a position with the Fullerton Company (plant 4) New York, in charge of the negative preparing, copper depositing, plating and finishing departments.

L. B. Cheney, Connecticut representative of the Celluloid Zapon Company of New Haven, has been ill for the past month, but is now much improved and once more able to call on the trade.

W. T. Mayfield has been appointed Southern representative of the Detroit Brass and Malleable Works, handling brass goods and malleable iron fittings, covering all of the Southern states except Texas.

Charles L. Witherell, metallurgical engineer, 150 Nassau street, New York City, announces that he is open for engagement in a consulting capacity for the development, design and investigation of metallurgical plants and processes, covering thermo, electro and hydro metallurgy.

Willard Fisher, who had been with the Illinois Zinc Co. for 28 years, has been appointed Eastern sales manager of the American Zinc Products Co. with headquarters at the New York office, 50 Church street, for the sale of sheet zinc, plate zinc and roofing material. M. L. Filley will remain manager of the local New York office.

Ex-President William H. Taft has agreed to undertake an investigation of the affairs of the American Smelting and Refining Company. The present management, as a result of the charges made by Karl Eilers, a stockholder and former official of the company, who has charged the present officials with mismanagement of the company's affairs, has requested Mr. Taft to make such an investigation.

J. K. Moses, crucible salesman with the Joseph Dixon Crucible Company for nearly twenty-five years, has severed his long standing connections with this well known concern and has joined forces with J. Goebel and Company, 67 Cortlandt street, New York, which concern has recently been given the sales agency for New York and New Jersey, of the Naugatuck Valley Crucible Company of Shelton, Conn., for their brand of black lead crucibles.

H. A. De Fries has opened offices at 15 Park Row, New York, as a consulting engineer and metallurgist, specializing in electric furnaces and electric furnace plant construction, and in the metallurgical problems in connection therewith. For the past 10 years he has held an executive position in this industry, lately as vice-president of Hamilton and Hansell, Inc., New York. He has resigned from this office, but will continue to act for them in a consulting capacity.

The Pease Laboratories, Inc., 39 West 38th street, New York City, announce that **Dwight Tenny,** chief engineer of the Franklin Baker Company, of New York, prior to that connected with the engineering staff of the National Biscuit Company, has become associated with them as head of the newly organized department of engineering. He will continue his connection with the former company as consulting engineer, having charge of all technical development work.

Lancaster P. Clark has resigned as treasurer and general manager of the Blake & Johnson Company, of which John P. Elton is president. Mr. Clark is a state senator. Two years ago he attained considerable prominence when he settled the strike of that spring, acting as mediator between the strikers and the manufacturers. Both sides paid tribute to his fairness at the time. A second attempt was made by him last summer to settle the ten weeks' strike but he was obliged to report failure.

Benjamin Gilchrist, who was superintendent of the electro-galvanizing plant of the Morgan General Ordnance Depot, and who has resigned this position to become superintendent of Simon Zinn Company, New York, was given a dinner at the New Paca House, Perth Amboy, N. J., by the government employees, including the executive staff, of the Morgan plant, on the evening of March 10. It was a most enjoyable affair, and the expressions of appreciation at the work done by Mr. Gilchrist at the plant were many.

DEATHS

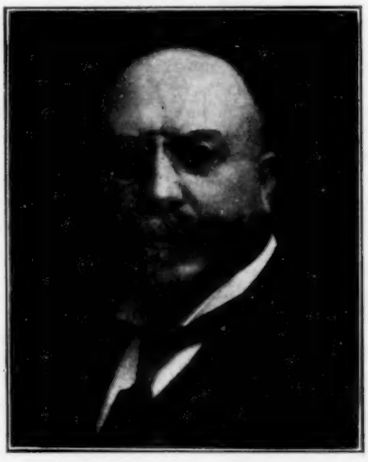
JACOB HASSLACHER

Jacob Hasslacher, well known in chemical circles, died at his home, 322 West 100th street, in the City of New York, on the morning of March 15, 1921, in the 69th year of his age.

Mr. Hasslacher was born in Ems-on-the-Lahn, Germany, in 1852, the son of Mr. and Mrs. George Hasslacher. His father held the important official position of Administrator of the Government bath, Parks and Buildings in Ems. He received his elementary education at the public schools at Ems and the Gymnasium at Hadamar, a collegiate institution, from which he was graduated in 1872.

For six years he was connected with the German Gold & Silver Refinery at Frankfort-on-the-Main. Mr. Hasslacher came to New York in 1884 and with Franz Roessler established the firm of Roessler & Hasslacher, manufacturing and importing chemists, and in 1889 the co-partnership was incorporated under the name of The Roessler & Hasslacher Chemical Company, with the head office at 73 Pine street, New York City. Under the wise and farsighted guidance of Mr. Hasslacher the business grew to its present eminent position. He was the leading factor in the formation and subsequent development of the Niagara Electro Chemical Company, the Perth Amboy Chemical Works, and in other enterprises in which the company is interested. After many years of active administration of these concerns, he was, on account of ill health and to the great regret of his associates, compelled to retire from active participation about a year ago. Despite his retirement, he maintained an active interest in all his former friends and their activities until a few days before his death.

Mr. Hasslacher was a member of many organizations, having the advancement of the Arts and Sciences at heart, among these were: The American Chemical Society, Society of Chemical Industry, American Electrochemical Society, American Association for the Advancement of Science, New York State Forestry Association, of which he was a vice-president; Metropolitan Museum of Art, American Museum of Natural History. He was also a member



JACOB HASSLACHER.

of many business and social organizations, such as U. S. Chamber of Commerce, N. Y. Chamber of Commerce, Chemists' Club, the Drug and Chemical Club, New York Athletic Club, Elka Park Association, in all of which he took an active interest.

Among his friends he was recognized as farseeing and broad in his views and purposes, forceful but tactful, willing at all times to subordinate his own wishes to the good of the cause he supported, liberal to give his friendship, effort and means, sympathetic and enthusiastic, an ardent lover of nature. Mr. Hasslacher was generous in his support of all charitable appeals irrespective of race or creed, he was an ardent citizen, naturalized in the year 1899, five years after entering his adopted country and gladly gave his support when his sons answered their country's call a number of years ago.

Mr. Hasslacher is survived by his widow, Mrs. Elizabeth Fleck Hasslacher, two sons, George and Carl, and four doughters, the Misses Agnes, Antonia, Therese and Emily Hasslacher.

ANDREW J. CORCORAN

Andrew J. Corcoran, who was the "father of railroad track elevation" in Jersey City and inventor of the first self-regulating windmill in the United States, died March 9, 1921 at his home, 15 Kensington avenue. He was born in Dublin, Ireland, over eighty years ago and came to this country with his parents in 1846. He lived in Brooklyn for a number of years and then went to Marcellus, twelve miles from Syracuse, N. Y. where he became apprentice to a blacksmith. When still far from being 21 years old he invented a windmill pump and he amplified his invention so that he went into business as a manufacturer of windmills. The first windmill took the prize at the Rochester, N. Y., fair in 1862. In that year he enlisted for service in the Civil War, but was excused on account of defective eyesight. He fought against being excused, but his objections were overruled. He then went back to the windmill making business. He started a plant in New York City and operated it for a number of years.

ANDREW J. CORCORAN

In 1887 he established his factory at Jersey avenue and Thirteenth street and from there his products were sent all over the world. During the siege of Ladysmith, South Africa, when the Boer War was at its zenith, the first thing hit was a Corcoran windmill.

Mr. Corcoran is survived by two sons, Robert and William, and two daughters, Mrs. Cassin and Mrs. Sweitzer.

ELIE MILLETT

Elie Millett, 69 years old, inventor of the Millett-Core Oven and founder of the Millett Brass Company, died in his home, 142 Thompson street, early in March after a long illness. Besides his wife he leaves one son, Dr. Eli F. Millett.

Mr. Millett lived in Springfield for more than 50 years and was one of the oldest residents of French descent. He was born in Champlain, N. Y., May 17, 1851, and after attending school for a short time moved to Manchester, N. H., where he worked in a brass foundry. Because of his unusual ability and the rapidity with which he learned his trade he soon advanced and was made foreman in the foundry division of the concern.

In 1907 Mr. Millett with L. J. Harley, Jr., organized the Millett Brass Company for the manufacture of aluminum, brass and bronze castings. They started with a force of 50 men but within four years the business had expanded to such a degree that more than 125 men were employed and the Millett Foundry was the largest in New England. In the meantime, the plant had been removed to East Springfield. About two years after the opening of the plant in Wilbraham avenue, J. Harley, father of Mr. Millett's partner had become interested in the possibilities of land in East Springfield. He induced the two partners to build their plant on an 11 acre tract there with a railroad frontage. In 1921 Mr. Millett sold his interest in the business to Mr. Harley and the company then was reorganized under the name of the Harley Company.

He was a member of Roswell Lee Lodge of Masons and Hampden Lodge of Odd Fellows.

CHARLES BURNETT LOWELL

Charles Burnett Lowell, for many years connected with the American Can Company, of this city, died at his late residence, 2722 Hampden avenue, Friday morning, March 11.

Mr. Lowell was born in Baltimore, September 4, 1878, and was a son of the late John B., and Annie E. Lowell, and was a brother of John W. Lowell, a New York city banker. He had been identified with the American Can Company for more than 17 years as mechanical expert in the die setting department.

Surviving Mr. Lowell are his widow, Mrs. Josephine Gernhart Lowell; a son, James Russell Lowell, and a daughter, Miss Clara Louise Lowell.

JOSEPH NELSON TALLMAN

Joseph Nelson Tallman, president of the Tallman Brass and Metal Company, Hamilton, Ontario, died at St. Joseph's Hospital, Hamilton, Ontario.

In the year 1896, he purchased from William Hunter his brass business, which grew steadily. Larger quarters were found, and at present the plant is one of the best in Ontario. His honest business methods and his interest in his work were, to a great measure, responsible for his success.

Mr. Tallman was born in Hamilton and made that city his home all his life. He was a member of the First Methodist Church, of the Chosen Friends and the A. O. F. He is survived by a widow, two sons, three daughters, a brother and three sisters.

JOHN BORKEL

John Borkel, for many years one of the leading manufacturers of metal work in New York, died suddenly, April 2, 1921, of heart disease on the elevated station at Third avenue and 125th street, New York. For more than thirty years his offices had been at Mulberry and Houston streets, where they adjoined the old building of police headquarters. As a young metal worker at the Webb Shipyards in East Ninth street he helped build the Monitor for the civil war, and later his firm made the bronze doors for Grant's tomb. He was born at Alzey, Germany, in 1844, coming to America as a boy.

DAVID W. PAYNE

Captain David W. Payne, U. S. A., retired, died at his home, 490 Greene avenue, Brooklyn. He was born at Corning, N. Y., in 1841, a son of the founder of the engine building concern of B. W. Payne & Son. While in the army he designed and built the first dredge boat used on the Mississippi and removed the wrecks of the Confederate ships sunk by Farragut at the mouth of that river. He was the editor of "Steam," the inventor of the Payne automatic engine, and the author of "Foundry Practice."

HORACE DYER SHERRILL

Horace Dyer Sherrill, who founded the Sherrill Jewelry Manufacturing Company in 1871, died at his home, 421 West 117th street, at the age of 76.

AARON W. WARSHAVSKY

Aaron W. Warshavsky, a manufacturer of silver-plated ware and part owner of the Continental Sheffield Silver Company in Brooklyn, died from heart disease on Tuesday at his home, 134 South Ninth street, Brooklyn. Mr. Warshavsky was born in Russia forty-seven years ago. He was a member of the Brooklpn Federation of Jewish Charities and the Zionist Organization of America.

JOHN M. STARR

John M. Starr, Starr Brothers' Manufacturing Company, East Hampton, Conn., bell manufacturer, died at his home there March 16, aged 75 years. He was treasurer of the Pocotopaug Water Power Company and a director of the Middletown Trust Co.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

APRIL 4, 1921.

Announcement of a 10 per cent reduction in the wages of all office employes and salaried men and a cut of five cents an hour in the pay of all other workers has been made by officials of the **American Brass Company,** the reduced rates of pay being effective the first part of April.

This is the first reduction that the American Brass Company has made. The company is one of the last concerns in the city to take such action. The company's announcement included regret for a step which was found necesssary. The American Brass Company is still running on a short time basis. Further cuts in wages at other Waterbury factories are momentarily expected.

Possibly one of the most unique records ever achieved by the employees of any factory of its size may be attributed to the employes of the American Pin Company of Waterville. A comparatively small group of employes, 44 to be exact, have achieved an aggregate length of service extending well over a thousand years. Not one of the group has less than 25 years to his or her credit. It is a debatable question as to whether the employers or employes are most proud of this enviable record. The group includes executives, salesmen, foremen, forewomen and metal workers—representatives of all departments in the plant. Of the remaining employes, 256, or one-third, have been with the company five years or more.

In the group of 44 there are six who have served 35 years or more; 12 who have served from 30 to 34 years, and 26 who have served from 25 to 29 years. Heading the list of this interesting study in figures are Edward Smith, with 51 years to his credit, and Mrs. Margaret Finnegan, who has been with the concern 45 years. The two have worked for three presidents: Theodore Driggs, George Driggs and Theodore I. Driggs—grandfather, father and son—in the order named. Theodore I. Driggs is now president of the concern. H. G. N.

TORRINGTON, CONN.

APRIL 4, 1921.

All Torrington factories are working on part time schedules with greatly reduced forces. Similar conditions exist throughout the Naugatuck Valley. An industrial investigator of the Labor Bureau recently completed a survey of conditions in the valley and reported that in Waterbury alone 5,000 men are out of work. A large number of women in the various towns, unable to obtain work in factories, are seeking housework and other employment. There is also a noticeable lack of work in Naugutuck, the investigator reported. The depression in business, it was stated, was found to be general throughout the valley. Many optimists who believed that there would be a noticeable revival about April 1, are now admitting that conditions are not likely to improve greatly until Fall. Family men in desperate need of assistance are being employed on special jobs by the town and borough of Torrington in an effort to aid in improving the situation here.

Major W. E. Besse, superintendent of the Torrington Branch of the American Brass Company, has received word of the death of his brother in Switzerland. Major Besse only recently returned from Switzerland, where he went to visit his brother who had been ill for a long time. J. H. T.

AMERICAN PIN COMPANY VETERANS.

NEW BRITAIN, CONN.

April 4, 1921.

Already spring is here, but as yet, there are no visible signs of the great industrial revival to which the optimistic have been looking forward and for which the manufacturers have been hoping. New Britain, no different than other manufacturing centers, is deep in the trough of a manufacturing depression that shows little sign of continuing on to the crest of a wave of prosperity very soon. Practically every factory in the city is operating not only on a very much reduced personnel of workers, but also on short hours. Orders are few and far between, the manufacturers show but little inclination to lay in heavy stocks of their products at this time and all in all the outlook is anything but encouraging.

The **New Britain Machine Company** which went virtually out of existence, insofar as production is concerned, many months ago, has not shown much life. Even the office force has been cut down 20 to 40 per cent in pay, likewise in number. True, this concern did have a sizable stock of finished machines on hand which have been delivered as ordered, but business is, without any qualification, flat. In the tractor department, which was hoped to prove the savior of the factory, there is no indication of surprising activity.

The **North & Judd Manufacturing Company** is also showing little signs of picking up and although hopeful statements are given out occasionally by the management, these have borne but little fruit. The same is true at the **Traut & Hine Manufacturing Company.** The **Fafnir Bearing Company,** closed down entirely since late last Fall, has made no pretense of reopening. This concern specializes in ball bearings of all types and relies chiefly on the automobile industry to keep it going. Evidently there has not been a sufficient pick-up to the auto trade to be reflected back here. The **Corbin Cabinet**

Lock, the **P. & F. Corbin**, the **Corbin Screw** and the **Russell and Erwin** divisions of the **American Hardware Corporation** are plodding along on reduced hours and a certain curtailment of employes, awaiting a much hoped for revival of the building business. The **Stanley Works** and the **Stanley Rule & Level Company** is in much the same situation.

Probably the concern that is doing the best right now is the **Landers, Frary & Clark Company**, which, because of the diversified products manufactured, can always manage to keep going. The cutlery department, the silverware department, the culinary articles department, the vacuum bottle department, the celluloid department and other branches are doing well, although it is true that the number of employes has been cut somewhat and the wage scales have also been lowered. Within the past few weeks the Landers, Frary & Clark Company have removed one dangerous competitor from the field. It has purchased the plant and business of the **Stanley Vacuum Bottle Company**, of Great Barrington, Mass. This concern was the manufacturer of a vacuum bottle which was considered a dangerous competitor for the local concern. The purchase entailed quite a considerable amount.

The **Bristol Brass Company**, one of the leading brass mills of the east during the war boom, is still in good condition and doing a fair business, but as a conservative act, in view of general conditions, the usual dividend has been passed.

At the recent meeting of the stockholders of the American Hardware Corporation the same officers were re-elected. The same is true at the **Landers, Frary & Clark Company**. —H. R. J.

ROCHESTER, N. Y.

APRIL 4, 1921.

The advent of April finds manufacturing conditions in Rochester in precisely the same state as that of a month ago. Here and there certain metal-using industries report a continued upward movement—an increase in production and demand that is of an encouraging nature, and tends to inspire confidence in the near future. But in some of the larger concerns, a feeling of pessimism still exists, and that condition is going to prevail for some time, or until there is a radical departure in the business world.

Just now, Rochester industries are turning an inquiring ear toward Central and South America, Mexico and the American dependencies. It is realized that a rich field in much of this part of the world awaits development. The labor situation has not affected the Rochester metal-using industries to a great extent as yet.

Considerable buying of raw materials has been going on since the first of the year. Much copper has been acquired here, but while the price is admitted to be low at this time, it is believed that the bottom has been reached, and that after this week the values of all copper and brass shapes will gradually ascend. The market for tin is correspondingly quiet here, and aluminum and lead are not in demand. There is some inquiry for zinc, but the market is not more than steady.

The railroad situation in Rochester is still improving, freight and express shipments being of a satisfactory nature. G. B. E.

NEWARK, N. J.

APRIL 4, 1921.

A break in the business depression which has hung upon the metal trades of Newark and vicinity is looked for soon by most of the manufacturers. Members of the **Newark Foundrymen's Association** expressed the opinion that things were bound to change soon because they could not continue at the present gait much longer.

"The business houses which we supply," said the head of a large electro-platers' supply house, "have not been buying anything to speak of for about six months. Very soon they have got to start buying again or go out of business altogether, because they can't keep their plants in running condition on the small amount of business they have been doing. March was a little worse than the preceding months, if anything, and I think that was the darkest part of the cloudy period—which always precedes the dawn."

Dealers report that the automobile factories and dealers in automobile accessories have given signs of coming to life again after four months of a lay off. Manufacturers in the metal industries have been doing their best to hold together as much of their working forces as possible, in anticipation of renewed activities. Some of the manufacturers have had so few orders that they have been compelled to cut down their working force to a small percentage of what it would be normally, but nearly every plant reports that it is keeping open shop and has on hand the nucleus of another working organization when the break for better business comes. H. R. K.

TRENTON, N. J.

APRIL 4, 1921.

The old plant of the Trenton Lamp, Brass and Copper works on Mulberry street, Trenton, has been sold to the Rotex Manufacturing Company, imitation leather manufacturers of Cleveland, O. The plant sold for $100,000.

The metal industry plants in Trenton are still feeling the slump in business and are anxiously waiting for conditions to reach normal again. As a number of plants are operating only two to four days a week, the employment situation is a very serious one just now. Workmen can scarcely exist on the wages paid now—that is, what they receive for two or three days' work a week—and besides many of them have homes to pay for. The situation has become so bad that real estate dealers have decided to hold over payments on properties until the tenants secure steady work.

Arthur D. Reeve will erect a one-story factory building at 318-326 Passaic avenue, Newark, N. J., 40 by 50 feet, for the manufacture of brass. The company also plans for refining and assay laboratories and an office building.

Hanson & Van Winkle, 267 Oliver street, Newark, N. J., manufacturers of dynamos, will make alterations to the plant to cost $25,000.

Barrasso & Blasi, Inc., jewelry manufacturers of 112 Arlington street, Newark, N. J., have started work on a two-story and basement factory building, 56 by 80 feet to contain three fireproof vaults. The plant will cost $35,000.

The **Noxon Company**, manufacturers of metal polishes, Newark, N. J., has purchased a three-story factory building on Morris avenue and will remove there when the plant is overhauled.

New Jersey Lamp & Brass Company, of Newark, N. J., has been chartered with $100,000 capital by Ralph Cortese and F. D. Masticci, of 185 Market street.

Ernest C. Felner Company, Inc., of Hoboken, has been chartered at Trenton with $25,000 to deal in cutlery. Ernest C. Fellner, Gustave Schild and Ferdinand Roederer, of Hoboken, are the incorporators.

Carl H. Wolf, Inc., of Newark, has been chartered at Trenton with $5,000 capital to deal in metals. The incorporators are: Carl H. Wolf, S. C. Deixel, Newark; Hugo C. Wolf, Bloomfield.

Holley Manufacturing Company, of Newark, N. J., has purchased factory buildings on South and Dawson streets and will erect additions for the plating department. The company manufactures metal stamped goods. With the purchase of the property the company will enlarge the plant extensively, going into the different branches of their metal manufacturing business.

Globe Electrical Fixture Manufacturing Co., of 613 Springfield avenue, Newark, has been incorporated with $10,000 capital to make electrical fixtures. The incorporators are Fred Wilson, William H. Freeman, of Newark; Pemberton Dudley and Edith B. Dudley, both of Asbury Park.

New Process Metals Corporation, of Division street, Newark, has been chartered at Trenton with $250,000 capital by Walter F. Young, Newark; Sidney T. Edge, West Paterson, and Frank J. Morris, of West Orange. The company will manufacture metal novelties.

The **Magnallow Metal Corporation of America**, with offices in Montclair, N. J., has been incorporated with $125,000 capital stock to manufacture metal goods. The incorporators are Walter Lohry, Julius Kumpa and Augustus L. Friedman.

BALTIMORE, MD.

APRIL 4, 1921.

The **Chesapeake and Potomac Telephone Company,** of Baltimore, Md., will spend $10,000,000 for an additional plant to take care of increasing needs in Baltimore before the close of 1923. The company's engineers have forecast the number of telephone stations which will be added to the system this year, in 1921, and are now laying plans for the future.

Charges of bribery and corrupting employes of the War and Navy Departments, the United States Railroad Administration and other government bodies are made in an amended declaration filed in the United States Court on March 21 by the **Alexander Milburn Company** in a $2,500,000 suit filed last December.

The suit, brought under the Sherman and Clayton Anti-trust Laws, is directed against the **Union Carbide and Carbon Corporation,** the **Union Carbide Company,** the **Union Carbide Sales Company,** the **Linde Air Products Company,** the **Prest-O-Lite Company, Inc.,** the **Oxweld Acetylene Company,** the **Oxweld Railroad Service Company** and the **Davis-Bournonville Company.**

The great new plant of the **Columbia Graphophone Company** at the eastern terminus of Biddle street, unfinished, still stands idle and deserted. Work on it was discontinued after the Christmas holidays, but, according to the contractors, work is expected to be resumed very soon, possibly in May or June. The Columbia company's Baltimore plant when finished, will consist of 19 buildings and will cover about 700,000 square feet of floor space. When in full operation it will employ 8,000 workers.—W. J. L.

CLEVELAND, OHIO

APRIL 4, 1921.

Approach of spring and finer weather may have nothing to do with it, but apparently the buying power of this community has improved in the last few weeks, and a corresponding increase in general manufacturing and consequently greater demands upon the metal industry have followed.

Two basic industries, the machinery and the automobile trades, report increased demands for their products. The better inquiries and more orders for standard machinery and machine tools reflect the improvement in general manufacturing lines, producers here point out, while the increased number of automobiles being purchased shows that the people again have money to spend.

The situation is further improved by the fact that more persons are being employed. Daily increases in employment are reported at practically all automobile plants here. In general manufacturing both East Side and West Side plants report improvement in demand for their outputs, but this gain is not as marked as in the two first trades mentioned. It is believed the low ebb of non-employment here was reached February 28, and that from now on a steady gain will be made. This will result in greater spending power, and in turn a normal condition of business is anticipated before the end of Spring. Such, at least, is the prediction of experts who are watching the situation here.

Another encouraging factor is the revival of activities in railroad yards here, 900 men, for example, having returned to work at the **Collinwood Shops** of the **New York Central Lines.** Locomotive shops had been closed since February 19. Moreover, the same wage and time schedules will hold, rail officials announce.

N. J. Grace, of this city, has been appointed superintendent of the **Garford Manufacturing Company** at Elyria. Mr. Grace will have charge of the personnel in the polishing and plating departments of the Garford company. For several years he was foreman at the National Safe Company.

Cleveland manufacturers are uniting to forestall any miscarriage of justice in the case of one **Sam Purpera,** confessed slayer of **Wilfred C. Sly** and **George K. Fanner,** officials of the W. W. Sly Manufacturing Company. Purpera was caught in Los Angeles, and has been brought back to Cleveland. Mr. Sly and Mr. Fanner were shot down several weeks ago by Purpera and a gang of bandits who stole the Sly company's payroll, which the officials were carrying with them. Effort will be made by the business men, backed by the Chamber of Commerce, West Side Chamber of Industry, Lakewood Chamber of Commerce, Cleveland Automobile Club and other institutions, to see that Purpera gets the extreme penalty for first degree murder. They will insist that Purpera is made an example of, as a warning to others who seek to slay and rob in the community.—C. C. C.

DETROIT, MICH.

APRIL 4, 1921.

The automobile is practically the only line that continues to show any amount of industrial improvement in Detroit and the immediate vicinity. It is estimated shipments have increased about 75 per cent during the present month with prospects for a further moderate increase in April.

It is reported difficult at this time for manufacturers to determine upon any definite production program for the year, simply because they have no way of knowing what the demand will be from one month to another. Most manufacturers say they are working up material on hand and are following the policy of producing only sufficiently to fill orders as they come in. Under this program stocks of raw material and completed cars are much smaller than last year at this time. They claim that diminished production during the winter was necessary because dealers had absorbed all they could carry before the year ended. Cars in the hands of dealers are not much greater than ordinary at the beginning of Spring, but the buying power manufacturers say has not manifested itself to the same extent that it did a year ago. Higher priced cars are moving more slowly than the moderate priced cars, but the demand for all classes seems to be gradually on the increase.

The **Ford Motor Company** has increased its production to 3,000 cars a day, so the report goes. Consequently the plant is now operating practically on full time or close to it. Labor trouble has caused three or four other plants to curtail production greatly or to suspend operations almost entirely. The trouble seems to center around a cut in wages. The men are firm in their demands and some picketing has been done, but otherwise no serious trouble has occurred. But, nevertheless, the strike has decreased production and caused many men to walk the streets for the lack of work.

There seems to be no decided improvement in the brass and copper business outside the automobile business. Manufacturers of plumbing supplies report but little production and the same report comes from other lines that use quantities of this material.

F. J. H.

ST. LOUIS, MO.

APRIL 4, 1921.

But slight improvement is reported by St. Louis metal foundries and plating establishments, both classes suffering from greatly curtailed production in all manufacturing lines. The depression in the South and Southwest, which was first felt by the retailer, is now being felt by the manufacturer in St. Louis and the plants supplying him with castings and parts.

The few plants that report an increase over the preceding month's business are doing enough work to keep their normal organizations intact. At many places, however, production averages between 25 and 50 per cent of business during war time.

Metals and metal products are slow to readjust and to this is ascribed the depression in the metal industry. The March report of the Federal Reserve Bank for the Eighth District states that unemployment in the metal industries is the most acute, ranging from 25 to 40 per cent. Plating work is at a virtual standstill owing to the suspension of manufacturing. The automobile plants in St. Louis are working on a part time basis, but in view of the recent announcement that Detroit plants started on April 1 to operate at 100 per cent normal production, hope is entertained here that the condition will soon be manifest in the Mississippi Valley. The

five large stove plants are now working on two and three day schedules, and great numbers have been laid off.

The Great Western Smelting and Refining Company reported conditions improving steadily, although an acute slump in January and February caused curtailment of the force. The local management is optimistic that the increase indicates a quick return to normal conditions.

A similar slight increase was reported by the **Mueller Bros. Brass Foundry Company** and the **More-Jones Brass & Metal Company.**

In the plating industry several plants complained of slack business, although Spring business is expected to furnish a great impetus. The **St. Louis Platers Supply Company** reported platers buying sparingly and only to cover actual requirements, in spite of attractive prices. The plant is figuring on new equipment for some shops, however, and this is considered an encouraging note.

The **Musick Plating Works** maintains a regular force, although business is not adequate to utilize the full factory equipment of the new addition to the building. Occasional orders, however, bring this extra machinery into use, and in those instances the addition is quite an asset, according to Edward Musick, proprietor.

The **Charles K. Schweizer Company** also reports business increasing. The **Progressive Electrotyping Company** is still operating a night shift, a recent patented multigraph cylinder which keys to the press, producing a large volume of business in itself.—W. G. R.

LOUISVILLE, KY.

April 4, 1921.

Business with the Louisville metal working trades is still quiet, the coppersmiths, including sheet metal and casting shops only working about half time, and reporting that business is not at all rushing, but prospects somewhat better than they were. Labor is in very fair supply and today it is merely a question of going out and securing business. In some sections labor is not quite as high as in Louisville, while in some sections of the country it is higher, with the result that competition is about on a fifty-fifty basis as controlled by labor. Under existing contracts local shops have no chance of reducing overhead costs to enable them to enter competition on lower price basis.

The automobile industry is picking up steadily, but at the present time there is not any large amount of this business coming to Louisville, other than such work as is done for some of the local auto, truck and tractor manufacturers, and this volume is not large.

Distillery work is very light, although there has been some little work in connection with plants which have run in a limited way in production of whiskey to be bonded and aged for future sale for medicinal use. There has been some easing in the prohibition regulations, which should be of assistance to the distillers.

The **Independent Brass Works** reports that instead of working eight men it is now working but four men in the casting department, which shows that its business is at just about 50 per cent of what it was last season when the demand was heavy.

The **Standard Sanitary Manufacturing Company,** which manufactures plumbing supplies, is working almost at capacity, due to a good volume of demand in connection with Summer building being in sight. The company is spending a good deal of money on some new additions.

The **C. Lee Cook Manufacturing Company,** which produces metallic packing principally, is not especially busy just now, operating about 50 per cent of capacity.

Demand for material from railroads is dull, as most of them in this district have laid off hundreds of shop men, and are not doing much repairing and no building of consequence. Due to railway labor board wages, the railroads are able to contract for cars with the independent car builders such as the American Car & Foundry Company, much more cheaply than they can build them in their own shops, as the independent car foundries do not have to pay the wage scale.—A. W. W.

MONTREAL, CANADA

April 4, 1921.

There is still a dull period that will force the manufacturers of brass, copper and metal goods to have patience and resourcefulness. The worst period is now over and a sudden rise to a rush of business would not be permanent or durable. A sudden rise at this stage would quickly renew the credit strain of last year and threaten possibly a more serious collapse.

Seasonal indications of improvement are already appearing and the improvement should be more pronounced within the next month. It is idle to expect, however, that we will have the extreme business activity such as has marked the past few years. Building operations are developing along the lines of activity early this season and with the jobbers at the present time not carrying large stocks in hand, inquiries and orders from that source will begin to arrive for plumbing and steam brass goods.

The **Taylor & Arnold Engineering Company** have now their new brass foundry in operation fully equipped with the latest appliances.

The **Royal Silver Plate Company,** 48 Craig street West, report a fair amount of business this year in gold, silver, nickel and repairs.—P. W. B.

BIRMINGHAM, ENGLAND

March 22, 1921.

The slump in trade continues and is being more and more severely felt in the non-ferrous metals industries. Practically all the works in the district are on short time, three days a week being the rule. The number of totally unemployed persons in Birmingham and the immediate neighborhood in all trades is over 60,000 and the weekly increase seems likely to continue at a high rate. The most active department of the brass trade is the manufacture of small stampings, but orders, though increasing in number, are small in bulk and far from sufficient to provide full employment. Sheet and tube business continues to fall off.

Jewelers are feeling very severely the effects of the general depression. Ther has been a certain amount of activity in the cheaper kinds, but this has fallen off as unemployment has dwindled to almost negligible dimensions. For the more expensive jewelry there is scarcely any demand either at home or abroad. In all markets British trade is suffering from increasing competition, especially from Germany.

In view of the impossibility of doing business on any profitable scale at present prices, manufacturers in all trades are looking to the work people to help them to reduce production costs, in which, in most of the metal trades, labor is the principal factor. The brass trade employers a month ago asked for the withdrawal of certain bonuses granted during the period of government control. This would have meant on the average a reduction of 15 shillings per week for men and 8 shillings per week for boys. The B. F. (National Society of Brassworkers) claimed that the employers were bound by agreement to maintain present rates of wages until June 30, but this contention was disputed. Repeated conferences have taken place and it is expected that this week a compromise involving a substantial reduction will be reached. A movement is on foot for the equivalent reductions in the wages of women and girls.

Prices of all the non-ferrous metals continue low, the pre-war level having been reached in some. The scrap metal trade is laboring under the disadvantage of having huge stocks of cartridge cases and other munition scrap thrown upon the market, not only by the British government, but also from neutral countries, which at the time of the Armistice were making munitions for enemy powers. The intrinsic value of this scrap is far above the prices at which it is being offered, but in the present state of manufacturing industry holders have scarcely any sale for it. In the state of foreign exchanges it is impossible to relieve the plethora by exporting scrap. Some of the firms which recover metal casters, ashes and other waste are practically at a standstill. With the decline of manufacturing, the quantities of waste materials have diminished by more than half, and with copper at its present price and the high railway charges the material cannot be dealt with at a profit.—H.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Eager Electric Company, Watertown, N. Y., announces that it is equipped to do jobbing work in producing and finishing gray iron castings.

Arthur Harris & Company, 212 North Curtiss street, Chicago, copper and brass founder, plans the erection of a new plant building, 51 x 52 feet.

The Trumbull Bronze Company, Warren, Ohio, has commenced operations in its new foundry which is 40 x 120 feet. They work in brass, bronze and aluminum.

The Southern Michigan Brass Foundry Company, Hudson City, Mich., has been incorporated by Richard Allingham and associates, with a capital stock of $5,000, to manufacture brass, bronze and aluminum castings.

The **United Metal Manufacturing Company,** Thamesville, Conn., will go on a daylight saving schedule of its own by changing its working day to 6 A. M.-3.45 P. M. instead of 7 A. M.-4.45 P. M. This schedule will hold from April 24 to September 25.

The Victor Aluminum Company, Wellsville, N. Y., recently increased its capital stock from $150,000 to $300,000. This concern operates a rolling mill, tool room, grinding room, and spinning, stamping, tinning, soldering and polishing departments.

A meeting of the creditors of the **Standard Parts Company** was held on April 12 at the Hollender Hotel, Cleveland, O., for the purpose of adopting a plan for terminating the receivership. Reports of this meeting were not in at the time of going to press.

The Pennsylvania Metal Reduction Company, 249 South Main street,W. E., Pittsburgh, Pa., has been incorporated with a capital of $10,000 to operate a metal refining plant. E. F. Straw, Pittsburgh, is treasurer. They operate a smelting and refining department.

The Fretz Brass and Copper Company, Philadelphia, has leased the property at 535 Arch street, where they have opened a store, office and warehouse, carrying a stock of tubes, sheets, rods, wire, etc., as well as handling the various alloys for mill shipments.

Brile & Ratner, 277 Broadway, New York, have opened an office in Cleveland at 440 Guardian Building in charge of John N. Brenza, where he will carry on their regular business as brokers in Metals and Chemicals in co-operation with the New York Office.

Albert Pick and Company, the hotel and restaurant equipment house of Chicago, announce the opening of a purchasing office in New York in the Marbridge Building, at Broadway and 34th street, where they are receiving offers of special merchandise. They are in a position to purchase large quantities for cash of special offers.

The **Renaissance Bronze & Iron Works, Inc.,** operating a modern factory and foundry for fabricating architectural and ornamental bronze and iron work, announces that R. Holstein, chief designer, A. S. Most, superintendent, and E. Michelsen, shop foreman, all formerly with the John Palacheck Bronze & Iron Company, are now identified with them.

The Imperial Japanning and Enameling Works, Inc., 408 West Grand avenue, Chicago, has been incorporated with a capital of $100,000 by John A. Skailand and William Link to manufacture enameled metal and japanned products, etc. They also do rust proofing by the Parker Rust Proofing Process. They operate a polishing, japanning and lacquering department.

The Chadwick-Carroll Brass Company, Ltd., Hamilton, Ont., Canada, has been incorporated with a capital stock of $40,000 by Walter W. Chadwick, Daniel T. Carroll and others, to manufacture brass goods, metals, etc. They operate a brass, bronze and aluminum foundry, brass machine shop, grinding room, casting shop, cutting-up shop, spinning, galvanizing, brazing, soldering, plating, polishing, japanning and lacquering departments.

W. B. Cuthbert & Company, 37 Duke street, Montreal, Canada, are rebuilding their plant recently destroyed by fire with a loss of $100,000. One building will be 66 x 83 feet, 3 stories, in which will be housed the machine shop and polishing and nickel-plating departments. A one-story foundry, 60 x 83 feet, will also be erected. New machinery will be installed. This firm operates a brass, bronze and aluminum foundry, tool room, grinding room, and plating and polishing departments.

The **Badger Die Casting Company** is the new name adopted by the Badger Bearing Company, 157 Buffalo street, Milwaukee, Wis. Heretofore they have specialized in the manufacture of Die Cast Bearings, but they are now in a position to handle die castings of all kinds. They intend to continue their general tool and die manufacture in which department they have been engaged mostly in the manufacture of die-casting dies for other die-casting concerns.

Brantford Computing Scales, Ltd., has acquired the plant of Kerr and Goodwin, Brantford, Ont., Canada, and will remove its business to the new quarters. The company intends to make additions to take care of foreign business. The building which it occupies at present (21,000 sq. ft. floor area) is for sale. This concern operates a brass and aluminum foundry, tool room, grinding room, and spinning, tinning, plating and polishing departments.

George W. Kyle announces that he has resigned as president and general manager of the General Platers' Supply Company, Inc., New York, in order to become the exclusive distributor of that company's merchandise and products. The business will be incorporated in the near future under the name of George W. Kyle & Company, Inc., with executive offices and warehouse in New York City. **H. L. Haas** also resigns as secretary of the General Platers' Supply Company, Inc., to become affiliated with the new firm.

The Bigsby Metals Company, 411 Long avenue, Cleveland, Ohio, an Ohio corporation, has purchased the good will of the Cleveland Alloys Company, and all right and title to their trade-marks, special brands, molds, laboratory, office and plant equipment, etc. Bernard Bigsby, head of the new organization, was one of the founders and for several years the president and general manager of the Cleveland Alloys Company. The Bigsby Metals Company has installed modern equipment in their new plant and will specialize in the manufacture of babbitt, solder and type metals, pig and ingot lead, aluminum and all white metal alloys.

The copper producing companies are greatly curtailing their output, due to the present market conditions. The Burro Mountain plant of the **Phelps-Dodge Corporation** has suspended operations and within the next few weeks additional properties, including the **Copper Queen** plant, probably also will suspend. It is reported that the **Inspiration Copper Company** has also decided to curtail operations pending improvement in the industry. Since the curtailment movement began the following companies are reported to have completely suspended opertaions: **Greene-Cananea, Inspiration, Old Dominion, North Butte, Phelps-Dodge** and several of the smaller mines in the lake districts.

The Engineering Business Exchange announces the opening of a Southeastern Branch with Mr. Marshall O. Leighton, Consulting Engineer, McLachlen Building, Washington, D. C., as Director. Mr. Leighton was for a dozen years one of the principal officers of the United States Geological Survey. During the past three years he has rendered a most valuable service to the engineering profession as the Chairman of the National Service Committee of the Engineering Council and the leader of the national organization which has carried on the campaign to reform the Government's business methods and establish a Federal Department of Public Works. Associated with Mr. Leighton in carrying on the Exchange will be Mr. A. C. Oliphant, who was also active in the work of the Engineering Council's National Service Committee.

The **Zeller Lacquer Manufacturing Company, Inc.,** has purchased the plant of Goodin-Reid & Company, Irvington, N. J., located on Lyons avenue, Cordier street and Lehigh Valley Railroad. The factory is a new one, of the latest fireproof construction of concrete and steel, with steel sash, giving the maximum amount of light, ventilation and cleanliness, and consists of five one-floor buildings, having a floor space of approximately 35,000 square feet, on four acres of land, with Lehigh Valley Railroad siding. The plant is equipped with all modern improvements, A. D. T. watchman and fire alarm system, etc., and enclosed by an eight foot Cyclone fence. Improvements are now being made to the plant, and the installation of new equipment begun. It is expected that operations will commence on or before June 1.

CIVIL SERVICE POSITIONS

The United States Civil Service Commission announces an open competitive examination for associate physicist qualified in physical metallurgy, at salaries ranging from $2,000 to $2,800 a year; and assistant physicist qualified in physical metallurgy, at salaries ranging from $1,400 to $1,800 a year, to fill vacancies in the Bureau of Standards, Department of Commerce, for duty in Washington, D. C., or elsewhere, and in positions requiring similar qualifications in other branches of the service, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion. Applicants should at once apply for form 1312 stating the title of the examination desired.

NATIONAL LEAD'S REPORT

The National Lead Company for the year ended Dec. 31, 1920, reports net income of $4,735,509 after charges and taxes, which after preferred dividends is equivalent to $14.67 a share on the $20,000,000 common stock as compared with earnings equal to $14.67 a share reported in the previous year. The profit and loss surplus as of Dec. 31, 1920, was $20,344,418 as compared with $18,553,965 at the close of 1919.

The general balance sheet as of Dec. 31 shows inventory of $19,602,194, an increase of $3,577,878, and cash on hand amounted to $3,719,880, an increase of $460,844.

NATIONAL CONDUIT & CABLE COMPANY

The Stockholders' Protective Committee of the National Conduit and Cable Company has notified stockholders regarding the plans for the rehabilitation of the company's finances. The plan opposes the sale of any part of the company's plant, but recommends the sale of a new issue of 8 per cent cumulative preferred stock in order to provide $1,200,000.

The letter sent to stockholders calls for drastic curtailment in all directions and provides for new working capital of between $500,000 and $1,000,000. The estimate is made that with the new funds the company can earn approximately $500,000 annually in addition to the $415,000 for deferred maintenance and improvements.

ENAMELING COMPANY REPORT

Stockholders of the National Enameling and Stamping Company held their annual meeting February 15, 1921, at which all of the retiring officers were re-elected. The report of the company for 1920 showed net profits of $4,229,000. After the deduction of fixed charges and setting aside $600,000 for Federal taxes, the balance amounted to $3,539,000.

The preferred dividend called for $700,000, leaving a balance of $2,839,000, from which there was deducted $177,000 for sinking fund requirements. The surplus available for the common stock amounted to $2,662,000.

THE INTERNATIONAL NICKEL COMPANY

CONSOLIDATED GENERAL BALANCE SHEET
DECEMBER 31, 1920

ASSETS

Property	$48,093,797.90
Investments	1,085,971.43
Inventories	11,764,482.86
Accounts and Bills Receivable	1,208,213.96
Loans on Call	2,015,000.00
Cash	1,757,997.14
	$65,925,463.20

LIABILITIES

Preferred Stock	$8,912,600.00
Common Stock	41,834,600.00
Accounts Payable and Tax Reserves	1,786,674.06
Preferred Dividend No. 61, payable Feb. 1, 1921	133,689.00
Accident and Insurance Funds	396,860.50
Exchange Reserve	250,000.00
Surplus April 1, 1920	10,391,233.38
Profit & Loss (Balance as per Statement)	2,219,806.35
	$65,925,463.29

CONSOLIDATED GENERAL PROFIT & LOSS STATEMENT
NINE MONTHS ENDING DECEMBER 31, 1920

Earnings		$4,415,774.20
Other Income		920,164.81
Total Income		$5,335,939.01
Administration and General Expense	$495,217.76	
Reserved for U. S. and Foreign Taxes (Estimated)	534,840.63	1,030,058.39
Net Income		$4,305,880.62
Depreciation and Mineral Exhaustion		1,685,007.27
Profits		$2,620,873.35
Dividends		
Preferred No. 59—		
Paid August 2, 1920	133,689.00	
Preferred No. 60—		
Paid November 1, 1920	133,689.00	
Preferred No. 61—		
Payable February 1, 1921	133,689.00	401,067.00
Balance		$2,219,806.35

NEW YORK, FEBRUARY 7, 1921

MARVEL COMPANY

The Marvel Electro Plating & Stamping Works, Inc., has located in the Marvel building, 109 East 116th St., New York City. Thomas S. Stretch, the superintendent of the plating department, advises that they are especially equipped to handle jewelry plating, such as mesh bags, etc.

The floor space is 5,000 square feet. Departments operated are plating, polishing, buffing, lacquering, burnishing and stamping. The equipment is up-to-date and they have just installed four new tumbling barrels and a new dynamo.

Mr. Stretch started as an apprentice in the plating department of Bradley & Hubbard Company, Meriden, Conn., and has followed the same business for a period of forty years. He is a popular member of the New York branch of the American Electro Platers' Society.

I. N. Seldes is treasurer of the company.

A NEW PRIZE CONTEST

Because of the growing and widespread interest in industrial cleaning and the fact that every industry is striving for greater efficiency in all manufacturing operations so that production costs may be lowered, the Oakley Chemical Company, New York, through the medium of a new Prize Story Contest, has, as stated in a preliminary announcement sent out a short time ago, undertaken to act again as a clearing house to bring out additional and useful ideas on every phase of cleaning and the manner and extent to which it influences quality and quantity of output.

Those in the metal working industries, where cleaning plays so vital a part in the production schedule, will find this subject, "To What Extent Does Cleaning Influence Production and Quality?" not only one that is unusually interesting but one which also provides an opportunity on which to write from many different angles. There will be $500 in prizes. The judges are Edward K. Hammond, Associate Editor Machinery; John H. Van Deventer, Editor Industrial Management; Clarence Hutton, Technical Editor Textile World Journal, and C. F. Radley, Editor Oakite News Service.

FIRE LOSSES

A compilation of fire losses in the United States from 1915 to 1919, inclusive, made by the National Board of Fire Underwriters, shows a loss in this period of $1,416,375,845, four times the amount spent in building the Panama Canal.

Electricity is the chief cause of fire, a total of $84,086,471 being traced to this source. Matches and smoking materials stand second, with a loss of $73,474,348 for the five years, while defective chimneys and flues hold third place, with a total of $56,650,915. New York's losses from fire are greater than those of any other State, the total for the five years being $140,305,821. Pennsylvania was second, $78,339,666; Illinois third, $73,916,503; New Jersey fourth, $63,679,525; Massachusetts fifth, $53,677,087. The losses from fire in rubbish and litter in New York were low compared with other States, being only $146,997, while in Illinois the loss was $501,018.—N. Y. Times.

BRITISH INDUSTRIES FAIR

The second of the British industries fairs, intended to rival the great fair at Leipzig, Germany, was opened on February 21 in London and Birmingham and closed on March 4; the third section, that at Glasgow, opening a week later, and closing on March 11. In the London section some 1,150 firms exhibited among them the principal manufacturers in the Birmingham jewelry trade.

Chief interest from the metallurgical point of view centred in the Birmingham section, which, as last year, was housed in the government aerodrome buildings at Castle Bromwich, about six miles from the centre of the city. The exhibits comprised electric, oil and gas lighting fittings and appliances, cooking and heating stoves and utensils, bicycles and motorcycles and cycling accessories, paints and varnishes, fishing tackle, engineering plant and machinery, belting, foundry plant, brass foundry, and a variety of other metal products, including general ironmongery, and a large display of galvanized, enameled and aluminum hollow-ware.

Once again the various associations in the non-ferrous metal trades presented a combined exposition of their manufacturing resources. It was this time a much larger and more illustrative collection and its arrangement was much more attractive. Tubes of brass and copper, plain and twisted ware were grouped with ornamental metal work in the form of two segments of Greek peristyles. There were also single tubes 12 ft. in length and 10 in. diameter contrasting with coils of drawn tubing of .0625 in. Brass and copper sheets 10 ft. and 4 ft. and of other sizes illustrated the process of cold rolling and there were specimens of flexible spirally built brass and copper tube which had been tested at high pressures for steam and water. Rods and strip and wire plain and fancy in brass, copper, nickel and phosphor-bronze made a particularly interesting display. The patterns in birds, flowers and other natural forms in the fancy wires were remarkable for their delicacy, the nickel-silver firms showing themselves specially eminent in these respects. Samples of castings were included. A notable feature of the demonstration was the progress in finish which has been made since the war. The German finish of rolled sheets and strip, which used to be the envy of Birmingham metallurgists, was considered to be excelled by specimens in this collection. Manufacturers in the Birmingham district in re-organizing their plant have paid special attention to the rolling of fine sheets and strip and are now prepared to produce with perfect accuracy and finish strip of .007 in. and even thinner gauges.

BROOKLYN INDUSTRIAL EXHIBITION

The fourth annual Industrial Exhibition held in Brooklyn, N. Y., during the week of April 2 to 9, at the 23rd Regiment Armory, proved to be even a greater success than its predecessors, occupying practically the entire drill floor of the large armory. The metal industries were well represented by firms manufacturing various lines.

Noteworthy exhibits of strictly metal firms that participated were those of:

Thomas Paulson & Son, who displayed their "Hecla" anti-friction babbitts and bronzes, in many different shapes of bearings and gears, and also aluminum castings.

Doehler Die Casting Company, who had a large exhibit of die cast white metals in innumerable shapes, and also brasses and bronzes cast in permanent molds.

Standard Rolling Mills, Inc., who exhibited their tin and lead foil products in various stages of manufacture, and also samples of articles for which they are used.

Alfred Nelson Metal Works, Inc., manufacturers of copper kettles, boilers, coffee urns, etc.

Reliance Metal Spinning and Stamping Company, stamped metal products of tin plate and copper.

Shapiro and Aronson, Robin Lighting Fixture Company and the **Hygrade Lighting Fixture Corporation,** each had a pretty display of lighting fixtures.

Other firms known to the metal trades who had notable exhibits were:

E. W. Bliss and Company, who had several metal stamping and punch presses on view.

Hilo Varnish Corporation, who exhibited their enamels, lacquers and varnishes for metals and other materials, particularly their "Lite-Grey" for machinery.

The **Metropolitan Brass Founders' Association** had a booth which was used as a meeting place for visiting foundrymen.

TRADE PUBLICATIONS

The Metal Industry Handbook and Directory, 1921.—A new edition of the book, issued annually, by THE METAL INDUSTRY, 34 Bedford street, Strand, London, W. C. 2, England, in paper binding. This new edition follows the same arrangement as the former editions, but additions have been made to several parts of the book. The most important features have been retained, and some of the latest work on the compositions of aluminum and zinc alloys have been added. New tables of the physical constants of several of the more important brasses and bronzes have been incorporated, also showing the effects of elevated temperatures and different annealing temperatures. New lists of times required for electrically depositing definite thickness of cobalt and nickel have been included, and data regarding the method of determining the "workability" of metal sheets and wires introduced in the section dealing with testing machines. The information regarding recent modifications in the testing of metals has been brought up to date, and fresh descriptions added of the more important new machines.

The Advantage Lies Within Your Grasp, If You Use U. S. Reduction Company's Babbitt.—A folder issued by the U. S. Reduction Company, Chicago, describing their various babbitts and their uses.

G.-R. Multiscreen Filter.—Bulletin No. 615, issued by the Griscom-Russell Company, 90 West street, New York, describing the G.-R. Multiscreen Filter, a redesign of the famous Reilly Feed Water Filter and Grease Extractor.

G.-R. Regenerative Compressor.—Bulletin No. 350, issued by the Griscom-Russell Company, 90 West street, New York.

Engine Indicators, Maihak Type.—A pamphlet issued by the Bacharach Industrial Instrument Company, Pittsburgh, Pa., describing and illustrating their new Engine Indicators, which are used on Diesel engines, automobile engines, aeroplane engines, etc.

Manometers.—A bulletin issued by the Bacharach Industrial Instrument Company, Pittsburgh, Pa., describing their new type of manometers for either pressure, draft or differential pressure.

Form Value of Energy in Relation to Its Production, Transportation and Application.—A reprint of a paper by C. G. Gilbert and J. E. Pogue, presented at the Fuel Session, Annual Meeting of the American Society of Mechanical Engineers, New York, December 7-10, 1920, issued by the W. S. Rockwell Company, 50 Church street, New York.

High Speed Induction Motors and Frequency Changers.—Bulletin No. 41521A, issued by the General Electric Company, Schenectady, N. Y. This bulletin goes into detailed descrip-

tions of the installation of these motors on various types of machines, showing illustrations in each case.

Electrical Equipments for Movable Highway and Railway Bridges.—Bulletin No. 48034, issued by the General Electric Company, Schenectady, N. Y. The advantages secured by the use of electricity in the operation of movable bridges of all types are concisely brought out in this bulletin.

Can You Match It?—Catalog 321, issued by the Jewelers' Technical Advice Company, 5 Cortlandt street, New York City, describing and illustrating the Hoke-Phoenix Gold and Platinum Melting Outfits, Combination Outfits, etc.

Fulton Diesel Oil Engines.—An attractively bound and well illustrated catalog issued by the Fulton Iron Works Company, St. Louis, Mo., describing their line of Diesel Oil Engines.

Are You Prepared?—A folder issued by the Electrical Company, Morristown, N. J., describing their wire and strip alloys.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$500	$600
American Brass	100	170	—
American Hardware Corp	100	133	—
Bristol Brass	25	15	20
International Nickel, com	25	14⅜	14¾
International Nickel, pfd	100	80	85
International Silver, com	100	25	—
International Silver, pfd	100	91	—
New Jersey Zinc	100	133	136
Rome Brass & Copper	100	135	145
Scovill Mfg. Co	100	300	350
Yale & Towne Mfg. Co	—	240	250

Corrected by J. K. Rice, Jr., & Co., 36 Wall Street, New York.

METAL MARKET REVIEW

WRITTEN FOR THE METAL INDUSTRY BY W. T. PARTRIDGE

COPPER

April 4, 1921.

Early in March, under small demand, prices of Lake electrolytic and casting copper were fractionally lower and later as keen competition developed between two customs smelting interests, prices were carried down to 12c. for electrolytic, 12¼c. for Lake and 11¾c. for casting, all early shipment. Even April, May and June shipment was sold as low as 12¼c. to 12½c. per lb. for electrolytic. Lake copper, in the outside market, was difficult to sell over 12¼c. to 12½c. for early shipment. Large producing interests, however, held firmly throughout the month at 12¾c. to 13c. delivered, for electrolytic. Late in the month, after announcement of the curtailment movement, a stronger tone was developed and even small producers who had been competing for business, advanced their prices of electrolytic to 12¾c. for prompt and April and to 13c. delivered, for May and June. In fact, one of the smaller interests at the close of the month was asking 13⅛c. for May and 13¼c. for June.

The distress of the copper industry is expressed in the passing of dividends by 18 of the principal producing and selling interests and the reduction of dividends by four other companies. Many of the producers delayed action in curtailing production because of the desire to assist miners and to hold working organizations intact, but it was necessary to reduce wages for the second time since the first of the year. Later, for the good of the entire industry, it became absolutely necessary to suspend production, that some of the large surplus accumulated during the war could be disposed of.

One interesting development during March was the sale of 30,000,000 pounds of brass cartridge cases at private sale by the Ordnance Board of the War Department. This sale was made on the basis of 41½% of the average market price for electrolytic copper in New York and 19½% of the average market price of prime Western spelter East St. Louis. The buyers were the Chase Companies, Inc., the Scovill Manufacturing Company and the Bridgeport Brass Company. Each company took a little less than 10,000,000 pounds, the total being 29,000,000 pounds. It was also agreed that the remaining 9,000,000 pounds of brass scrap in the hands of the Government should be sold only to other consumers on the same basis and terms.

In sympathy with the decline in prices for unwrought copper and the falling off in demand, a reduction of ¼c. to ½c. a pound was made in prices of finished copper and brass products.

The decision of eighteen producing companies to suspend operations entirely, indicates that output of United States smelters in the next sixty days will not be over 30,000,000 pounds a month as other companies have already reduced about 50% as compared with 1918 operations.

It is estimated that sales of copper on domestic and foreign account in March were approximately 80,000,000 pounds, but this is little more than a guess because few, if any, statistics are available. Sales in the preceding months of the year, also, are only approximate, but there is reason to believe that a total of 270,000,000 pounds were disposed of during the first quarter of this year.

TIN

Demand for tin from consumers and jobbers was conspicuous by reason of its absence during March, which is usually a good trading month with such buyers. Speculative interest, however, was continuous and influenced price changes which were based upon prevailing London quotations from day to day. Fluctuations were rapid and covered a range of 2¾c. per pound from the highest, established March 1, to the lowest, March 9. After the opening, spot Straits 30.25c., Banca 32c., American pure 31c. and 99% tin 27.25c., the decline was continuous to the lowest, Straits and American pure 27.50c., 99% tin 25.75c., followed by a gradual recovery to Straits and American pure 30c., and 99% tin 28.75c. by March 24. In the closing days there was a gradual decline to Straits and American pure 29c., 99% tin 27.87½c. on March 31. Thus there was a net decline of 1.25c. on Straits and American pure, and a net advance of ⅝c. on 99% metal. Banca tin was quoted nominally 31-32c. during only first three days of March. Arrivals during the month were 1,613 tons with stocks on hand and landing in New York 3,476 tons March 31, of which total there were 725 tons landing.

ZINC

The March zinc market after being quiet and steady at February closing prices, 4.75c. East St. Louis, 5.10c. New York for prompt, based upon foreign shipments and prevailing rate of duty, during first week, then assumed a stronger tone in sympathy with the probable checking of German exports due to higher London prices, and quotations March 8 were marked up to 4.85c. East St. Louis, 5.35c. New York. The advance, however, not being based upon improved consuming demand, was not held in the existing quiet market and prices gradually declined from day to day until March 18, when East St. Louis was 4.70c. and New York was 5.20c. In the succeeding few days, the market was steady, demand limited and prices unchanged until March 28, when with fewer inquiries and more or less apathy, East St. Louis was quoted 4.65c., New York 5.15c., there being no further change either in market conditions or in prices quoted. Thus, while there was a total advance of ¼c. per pound during the month, the net result was a 10 point decline East St. Louis and a 5 point advance, New York. According to specially collected statistics by the U. S. Department of Commerce, the importation of zinc pigs into this country, of metal previously exported during first half of 1920, and resold to buyers here at prices below those current in this country during latter half of the year, amounted at the end of January, 1921, to 8,355 tons.

LEAD

The stronger tone and brighter sentiment prevailing in the lead market during latter half of March had a sound foundation in actually improved conditions. Prices, after opening at the February closing, 3.90-4.00c. East St. Louis, 4.00c. New York, in the outside market, gradually, were advanced by March 8—the market in the meantime having been active and firm—to 4.00-4.10c. East St. Louis, 4.25-4.35c. New York. After remaining stationary in New York until March 17—there had been some shading in prices in the West in the meantime—New York quotations also were off five points, with East St. Louis 4.00c. On March 24, a distinctly better tone prevailed, attributed to the advance in London, the absence of foreign competition and active inquiry from home consumers, and prices were marked up to

4.05c. East St. Louis, 4.25-4.30c. New York. From that day forward, outside prices were advanced daily until the closing, 4.25-4.35c. East St. Louis, 4.45-4.50c. New York. The basis of the American Smelting & Refining Company, after opening at the February closing, 4.00c. East St. Louis and New York, was stationary until March 31, when it was advanced ¼c. per pound to 4.25c. East St. Louis and New York. The net advance in outside market prices was ½c. per pound.

ALUMINUM

After opening at the February closing, virgin 98-99% 23.50-24.50c., remelted 98-99% .20.50-21.50c., and No. 12 remelted 19.50-20.50c., prices in the outside market, in the absence of demand gradually declined to, virgin 98-99% 23-23.50c., remelted 98-99% 20-21c. and No. 12 remelted 19-20c, on March 10, with no further change in quotations over the remainder of the month. Thus, the net decline was ½c. per pound. The producer's schedule was unchanged during March at the February closing, virgin 98-99% 28.00c., No. 12 alloy 27.30c. and sheet 18ga and heavier 42.60c. in 15-ton lots f. o. b. producer's plant. Sheet for importation in the open market were offered around the middle of March at 35c., with the possibility of shading even this figure on attractive tonnages. While more interest was shown in aluminum during March, actual business transacted was not large in volume, but with actual improvement shown in the automobile trade, sentiment became more cheerful. Importations during January, 1921, were 568 tons and exports 280 tons. Stocks remaining in bonded warehouses January 31 were 1,655 tons.

ANTIMONY

Antimony prices ranged between 5.20c. duty paid carloads spot New York, at the beginning of the month to the highest level, 6.00c., March 11, and then down to the lowest, 5.12½c., March 24. Prices thereafter were unchanged making the net decline 7½ points. The upward trend was due wholly to rumors of anticipated tariff increase and not to demand. Consumption of the metal has not increased in any way, while on the other hand, large stocks exist, ocean freight have declined and also the price of silver. Importations in January, 1921, were 284 tons and stocks remaining in bonded warehouses January 31 amounted to 1,082 tons.

SILVER

Prices of silver bars of foreign origin reached the lowest level of the month, 52⅝c., March 4, the highest level being 58¾c. March 22, making the total range of fluctuations 6⅛c. per ounce. The net result from the opening, 55¾c., to the close, 57¼c. was a net advance of 1½c. Domestic bars, of course, were stationary at 99½c. Purchases of silver made by the Director of the Mint under the Pittman act to replace the 207,000,000 ounces sent to the Orient as a result of wartime emergency, were reported on March 23 to have reached a total of 40,152,996 ounces—Government purchases at $1.00 per fine ounce began May 13, 1920. Importations during January, 1921, according to U. S. Commerce Statistics were $4,838,868. Total exports during the same period were $6,690,748, indicating an excess of exports over imports amounting to $1,851,880.

QUICKSILVER

Demand for quicksilver in March was light. After opening at the February closing $47 per flask of 75 pounds, quotations were advanced to $47-50 March 9, but by March 14 were down to $46-47 per flask. On March 30 a further decline carried to $45-47 bid and asked. The market was nearly stagnant.

PLATINUM

The price of platinum was unchanged at $70 per ounce, the February closing until March 17 when quotations were advanced to $70-75, indicating diminished supplies. No further change occurred. Demand continued light but steady.

OLD METALS

Further depression in sentiment with downward tendency in prices of copper at the beginning of March, accentuated the pessimistic outlook in scrap metals. Stagnation prevailed, aluminum moving slowly and lead scraps holding their own, being the only exceptions on the list. Asking prices during first fortnight were shaded without result and market quotations remained unchanged. On February 15 there was a decline of ½c. per pound on many items, the whole market becoming more or less irregular. Two days later, quotations were again reduced. On March 23, however, some few orders were placed, small in quantity and with automobile radiators leading. From that time forward, improved sentiment was evident, due to returning confidence in the general business situation. At the end of the month coppers were off 1c. each on light copper to 7c. and strictly crucibled to 9.50c., while uncrucibled declined ¾c. to 8c. per pound. No. 1 composition turnings were down 1c. to 6.75c., composition scrap ½c. to 6.75c. Aluminum clippings and old sheet were unchanged at 12c. and 10c., respectively, while old cast aluminum was advanced 1c. to 11c. per pound. Among the ½c. declines were cocks and faucets, to 6.50c., heavy brass to $5.50c., new brass clippings to 6.00c. and clean red car boxes to 7.25c. The only advances were tea lead, ⅛c. to 2.12½c., and automobile radiators, ¼c. to 4.75c. per pound.

MARCH MOVEMENT IN METALS

Copper:	Highest	Lowest	Average
Lake	13.00	12.25	12.585
Electrolytic	12.37½	12.00	12.227
Casting	12.00	11.50	11.829
Tin	30.25	27.50	28.847
Lead	4.50	4.10	4.02
Zinc (brass special)	4.95	4.75	4.854
Antimony	6.00	5.12½	5.30
Aluminum	24.50	23.00	23.443
Quicksilver (per flask)	50.00	45.00	46.727
Silver (cts. per oz.) Foreign	58.75	52.62½	56.032

WATERBURY AVERAGE

Lake Copper, Average for 1920, 18.06. 1921, January, 13.75 February, 13.50.—March, 12.625

Brass Mill Zinc, Average for 1920, 8.33. 1921. January, 6.05—February, 5.50.—March, 5.25

Metal Prices, April 11, 1921

NEW METALS

Open Market

	Cents
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER.	
Manufactured 5 per centum.	
Electrolytic, carload lots, delivered	12¾-13
Lake, carload lots, delivered	13
Casting, carload lots, delivered	12
TIN—Duty free.	
Straits of Australia, carload lots	28¾
LEAD—Duty, Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	4.25-4.50
ZINC—Duty 15%.	
Brass Special	5.25
Prime Western, carload lots	5.15
ALUMINUM—Duty, Crude, 2c. per lb. Bales, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	....
100-lb., f. o. b. factory	....
Ton lots, f.o. b. factory	23-28½
ANTIMONY—Duty 10%.	
Cookson's, Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC. brand spot	5.12½
NICKEL—Duty, Ingot, 10% ad valorem. Sheet, strip, strip and wire, 20%.	
Ingot	41.00
Shot	41.00
Electrolytic	44.00
MANGANESE METAL—95-98% Mn., carbon free, per lb. Mn. contained	$0.75
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.25-$1.35
BISMUTH—Duty free	1.59
CADMIUM—Duty free	1.40
CHROMIUM METAL—95-98% Cr., per lb. Cr. contained	1.50
COBALT—97% pure ....Nominal	4.50
QUICKSILVER—Duty 10% per flask of 75 pounds	45.00-47.00
PLATINUM—Duty free, per ounce	75.00
SILVER—Government assay—Duty free, per ounce	.99½
GOLD—Duty free, per ounce	20.67

Metal Prices, April 11, 1921

INGOT METALS

Silicon Copper, 10%	according	to	quantity	26	to42
Phosphor Copper, guaranteed 15%	"	"	"	17	to25
Phosphor Copper, guaranteed 10%	"	"	"	16	to24
Manganese Copper, 30%	"	"	"	30	to40
Phosphor Tin, guarantee 5%	"	"	"	38	to48
Phosphor Tin, no guarantee	"	"	"	35	to45
Brass Ingot, Yellow	"	"	"	8⅜	to10
Brass Ingot, Red	"	"	"	12½	to14
Bronze Ingot	"	"	"	14½	to16½
Parsons Manganese Bronze Ingots	"	"	"	17½	to19
Manganese Bronze Castings	"	"	"	27	to36
Manganese Bronze Ingots	"	"	"	13	to16
Manganese Bronze Forgings	"	"	"	30	to40
Phosphor Bronze	"	"	"	24	to30
Casting Aluminum Alloys	"	"	"	21	to26
Monel Metal	"	"	"	38	to..

OLD METALS

Buying Prices		Selling Prices
9½to 9¾	Heavy Cut Copper	11 to12
8½to 9	Copper Wire	10 to11
7½to 8	Light Copper	9 to 9½
9½to10	Heavy Machine Comp	11½to12
6 to 6½	Heavy Brass	8 to 8½
4 to 4½	Light Brass	6 to 6½
5 to 5½	No. 1 Yellow Brass Turnings	6½to 7
8½to 9	No. 1 Comp. Turnings	10 to10½
3½	Heavy Lead	4
3½	Zinc Scrap	4
6½to 9½	Scrap Aluminum, Turnings	7½to10½
15½to17½	Scrap Aluminum, cast alloyed	18.00to19.50
18.50	Scrap Aluminum, sheet (new)	21.00
25.50	No. 1 Pewter	29.50
14½	Old Nickel anodes	16½
22½to24½	Old Nickel	26½to28⅛

BRASS MATERIAL—MILL SHIPMENTS

In effect January 10, 1921.

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.17¼	$0.20½	$0.22¼
Wire	.18¼	.21½	.23¼
Rod	.15¼	.21½	.23¼
Brazed tubing	.29	..	.35½
Open seam tubing	.29	..	.35½
Angles and channels	.34	..	.40½

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.18½	$0.20½	$0.22¼
Wire	.19½	.21½	.23¼
Rod	.16½	.21½	.23¼
Brazed tubing	.30¼	..	.35½
Open seam tubing	.30¼	..	.35½
Angles and channels	.35¼	..	.40½

SEAMLESS TUBING

Brass, 21c to 22c. per lb. base.
Copper, 22c. to 23c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	19¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	17¼c. " "
Muntz or Yellow Rectangular Sheets other than Sheathing	18¼c. " "
Muntz or Yellow Metal Rod	15¼c " "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	20c.-22c. net base
From stock	22c.-26c. net base

BARE COPPER WIRE—CARLOAD LOTS

15¼c. to 16¼c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	22c. per lb. base
100 lbs. to 300 lbs. in one order	23c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 11c. basis less 8 per cent. discount.

Casks, jobbers' prices	13c.
Open casks, jobbers' prices	13½c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	42½c.
Aluminum coils, 24 ga. and heavier, base price	37½c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	30¾c.	per lb.
15% "	33¼c.	" "
18% "	34c.	" "

Nickel Silver Wire and Rod

10% Quality	33c.	per lb.
15% "	37¼c.	" "
18% "	40c.	" "

MONEL METAL

Shot	35
Blocks	35
Sheet Bars	40
Hot Rolled Rods (base)	42
Cold Drawn Rods (base)	56
Hot Rolled Sheets (base)	55

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25s. over. Above prices f. o. b. mill.

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 60c. to 62c. per Troy ounce, depending upon quantity.

Rolled sterling silver, 59c. to 62c.

NICKEL ANODES

85 to 87% purity	.50c.	per lb
90 to 92% "	.52½c.	per lb
95 to 97% "	.55c.	per lb.

Supply Prices, April 11, 1921

CHEMICALS

In Commercial Quantities

Acid—		
Boric (Boracic) Crystals	lb.	.17
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.03
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg. Carboys	lb.	.07½
Nitric, 42 deg. Carboys	lb.	.07¾
Sulphuric, 66 deg., Carboys	lb.	.02½
Alcohol—		
Denatured	gal.	1.00
Alum—		
Lump, Barrels	lb.	.05
Powdered, Barrels	lb.	.06
Aluminum sulphate, commercial tech	lb.	.03-.05
Aluminum chloride solution	lb.	.20
Ammonium—		
Sulphate, tech., Barrels	lb.	.05
Sulphocyanide	lb.	.75
Argols, white, see Cream of Tartar	lb.	.80
Arsenic, white, Kegs	lb.	.12
Asphaltum	lb.	.35
Benzol, pure	gal.	.45
Blue Vitrol, see Copper Sulphate.		
Calcium Carbonate (Precipitated Chalk)	lb.	.07
Borax Crystals (Sodium Biborate), Barrels	lb.	.08
Carbon Bisulphide, Drums	lb.	.10
Chrome Green	lb.	.75
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.48
Carbonate, Barrels	lb.	.26
Cyanide	lb.	.63
Sulphate, Barrels	lb.	.06½
Copperas (Iron Sulphate, bbl.)	lb.	.02½
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.40
Crocus	lb.	.15
Dextrin	lb.	.10
Emery Flour	lb.	.07
Flint, powdered	ton	—
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	3.50
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	—
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	.02½
Lead Acetate (Sugar of Lead)	lb.	.17-.18
Yellow Oxide (Litharge)	lb.	.12-.16
Mercury Bichloride (Corrosive Sublimate)	lb.	1.15
Nickel—		
Carbonate Dry	lb.	.55
Chloride, 100 lb. lots	lb.	.47-.50
Salts, single, bbls	lb.	.12-.13
Salts, double, bbl	lb.	.14-.15
Paraffin	lb.	.10
Phosphorus—Duty free, according to quantity		.30-.35
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	.12
Electrolytic, 70-75% fused	lb.	.10
Potassium Bichromate, casks	lb.	.14
Carbonate, 80-85%, casks	lb.	.10-.12
Cyanide, 100 lb. drums, 94-96%	lb.	.45-.50
Pumice, ground, bbls	lb.	.05
Quartz, powdered	ton	—
Official	oz.	—
Rosin, bbls.	lb.	.05
Rouge, nickel, 100 lb. lots	lb.	.40
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.07½
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.40
Soda Ash, 58%, bbls	lb.	.03
Sodium—		
Biborate, see Borax, bbls	lb.	.08
Bisulphite, tech. bbls	lb.	.05¾
Cyanide, 96 to 98%, 100 lbs	lb.	.28-.30
Hydrate (Caustic Soda) bbls	lb.	.05½
Hyposulphite, kegs	lb.	.05
Nitrate, tech. bbls	lb.	.04½
Phosphate, tech., bbls	lb.	.0(
Silicate (Water Glass) bbls	lb.	.03
Sulpho Cyanide	lb.	.75
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.17
Sulphur (Brimstone) bbls	lb.	.03
Tin Chloride	lb.	.40
Tripoli	lb.	.03½
Verdigris, see Copper Acetate	lb.	.48
Water Glass, see Sodium Silicate, bbls	lb.	.03
Wax—		
Bees, white ref. bleached	lb.	.70
Yellow, No. 1	lb.	.30
Whiting, Bolted	lb.	.06
Zinc, Carbonate, bbls.	lb.	.20
Chloride, 600 lb. lots	lb.	.12
Cyanide	lb.	.46
Sulphate, bbls.	lb.	.04

COTTON BUFFS

Open buffs, per 100 sections (nominal).		
12 inch, 20 ply, 64/68, cloth	base,	$32.10
14 " 20 " 64/68, "	"	39.95
12 " 20 " 84/92, "	"	45.85
14 " 20 " 84/92, "	"	61.75
Sewed buffs, per pound		
Bleached and unbleached	"	.65

FELT WHEELS

		Price Per Lb.
White Spanish—		
Diameter— 8" to over 16"	Thickness—½" and ¾"	$4.00
" 8"	" 1" to 3"	3.10
" 10" to 16"	" 1" to 3"	3.00
" over 16"	" 1" to 3"	3.10
" 8" to over 16"	" over 3"	3.40
Grey Mexican—		
Diameter— 8" to over 16"	Thickness—½" and ¾"	$3.90
" 8"	" 1" to 3"	3.00
" 10" to 16"	" 1" to 3"	2.90
" over 16"	" 1" to 3"	3.00
" 8" to over 16"	" over 3"	3.30

Above are even diameters. Odd diameters 50c advance.